PB81-105850

Northglenn Water Management Program City of Northglenn, Colorado. Appendix

(U.S.) Environmental Protection Agency
Denver, CO

27 Jun 80

U.S. Department of Commerce
National Technical Information Service
NTIS.

PB81-105850

United States
Environmental Protection
Agency

Region 8
1860 Lincoln Street
Denver, Colorado 80295

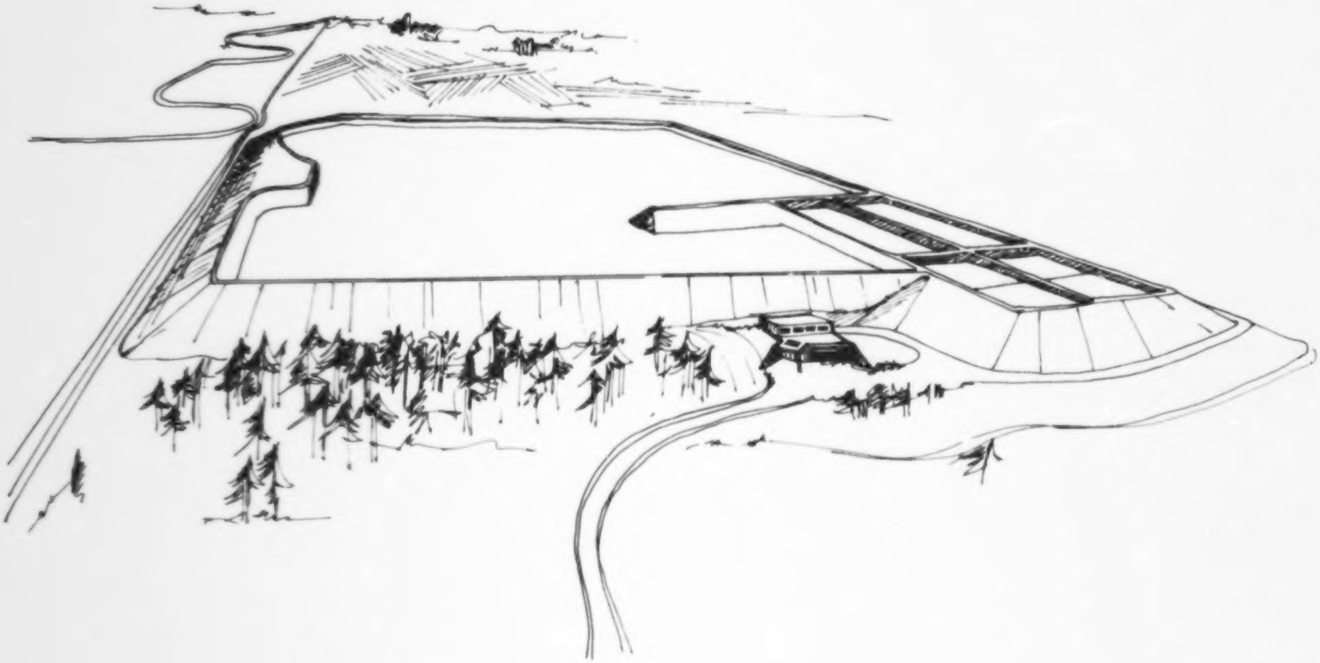
EPA 908/5-79-002C
June, 1980

EPA

Environmental Impact Statement

Final

Appendix



Northglenn Water Management Program
City of Northglenn, Colorado

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City of Northglenn, Colorado

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Weston W. Wilson and William Rothenmeyer, EPA
Al Udin and Paul Seeley, Engineering Science, Inc.

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
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2785 North Speer Blvd., Suite 140
Denver, Colorado 80211

10. PROGRAM ELEMENT NO.

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U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado

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Environmental Appraisal and Negative Declaration dated September 29, 1978, issued by EPA. Draft Environmental Impact Statement dated January 11, 1980 also issued by EPA.

16. ABSTRACT

This is a final Environmental Impact Statement (EIS) for proposed construction of facilities to provide water supply, wastewater treatment and agriculture reuse of sewage effluent for the City of Northglenn, Colorado. Under an exchange agreement with the Farmers Reservoir and Irrigation Company, approximately 5,000 acre-feet annually will be diverted for Northglenn's municipal use, treated, augmented from other sources, stored, and then returned for irrigation purposes.

The U.S. Environmental Protection Agency (EPA), Region VIII, Denver, under the authority of Section 201 of the Federal Water Pollution Control Act Amendments of 1972, is authorized to grant 75 and up to 85 percent matching funds for construction costs of designated wastewater treatment facilities.

The recommended action is to construct an 8 mile interceptor, aerated lagoon and a storage reservoir. Implementation of the exchange program negates the pending water condemnation actions that are in progress.

The appendix includes responses by EPA to comments recieved on the draft EIS, analysis of the alternative systems and cost estimates.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Wastewater Reclamation Sewage Irrigation Agricultural Reuse Water Pollution Flow Augmentation Plan Alternative Wastewater Treatment Technology Environmental Impact Statement	Denver Regional EIS for Wastewater Facilities and the Clean Water Program Denver Metro Sewage Farmers Reservoir and Irrigation Company	

18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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EPA - 908/5-79-002C

FINAL ENVIRONMENTAL IMPACT STATEMENT
NORTHGLENN WATER MANAGEMENT PROGRAM
CITY OF NORTHGLENN, COLORADO

APPENDIX

EPA

Prepared by

U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

1a

INTRODUCTION

This volume of the Northglenn Water Management Program Environmental Impact Statement contains supporting information and documents for the summaries, conclusions, and decisions presented in the main volume of the EIS.

Much of the information presented herein was developed subsequent to the issuance of the draft EIS for public review, and in anticipation or in response to comments received from individuals, organizations and groups, and government agencies at the local, regional, state and federal level.

Written comments received together with EPA's responses to these comments are contained in Appendix A. Appendix B and Appendix C are taken from the Draft EIS and contain basic information necessary to support impact analyses. Appendix C through Appendix J present new information, and Appendix K and Appendix L are draft agreements necessary to implement the project. Appendix M is an analysis of another water supply alternative submitted by opponents to the plan but too late to be included in Chapter 3. Appendix N is an analysis by Northglenn's engineers in response to the review of the proposed system performance presented in Appendix E.

ACKNOWLEDGEMENTS

Because of the magnitude of the effort required to produce this environmental impact statement, it is an impossible task to acknowledge all of the people and agencies who contributed to the final product. A heart-felt thanks is extended to the individuals who have contributed and assisted in the completion of this monumental effort. A special thanks is offered to all of the secretaries without whose patience and long hours the project could not have been competed.

DISCLAIMER

This report has been reviewed by the EPA, Region VIII, Water Division and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

DOCUMENT AVAILABILITY

This document is available in limited quantities through the U. S. Environmental Protection Agency, Environmental Evaluation Branch, 1860 Lincoln St., Denver, Colorado 80295. This document is also available to the public through the National Technical Information Service, Springfield, Virginia 22161.

APPENDIX A

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COLORADO
HISTORICAL
SOCIETY

The Colorado Heritage Center 1300 Broadway Denver, Colorado 80203

January 16, 1980

Roger L. Williams
Regional Administrator
U.S. Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams,

1 This is to acknowledge receipt of the Draft Environmental Impact Statement for the Northglenn Water Management Plan, Northglenn, Colorado.

Date Received: January 14, 1980 Date Due: February 25, 1980

Since this proposed project apparently will not affect Cultural Resources, responsibilities under 36 CFR 800 are fulfilled by retaining documentation of review by this office.

Thank you for the opportunity to comment on the proposed project.

If this office can be of further assistance, please do not hesitate to call upon ES Reviewer Betty LeFree (Office of the State Archaeologist) at 839-3391.

Sincerely,

Arthur C. Townsend
Arthur C. Townsend
State Historic Preservation Officer

cc: B. Rippeteau State Archaeologist
J. Hartmann Coordinator, Historic Preservation
J. McGregor, Sheaffer & Roland, Inc.

ACT(BJL)

JAN 2 1 [illegible]

RESPONSE:

1. EPA acknowledges that the proposed project will not affect cultural resources.

THE ROCKY MOUNTAIN
FUEL COMPANY

January 17, 1980

24019

Mr. Roger L. Williams
Regional Administrator
United States Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams

The "Draft Environmental Impact Statement" of the Northglenn Water Management Program discusses on page 7 of chapter one, the need for ponds to control the irrigation tailwaters flowing into the Town of Frederick.

For Northglenn to comply with this requirement, it would be necessary for Northglenn to purchase land owned by this company.

Please be advised of the following:

1 1) Northglenn has made no offer to this company to purchase such land.

2 2) The sale of a parcel of land of the size required would be contrary to the subdivision and zoning ordinances of Frederick,

3 3) The location of the proposed tailwater pond would seriously diminish the value of the remaining land, and

4 4) It is unlikely that this company would sell this site to Northglenn because of the strong public opposition of the Northglenn plan by citizens of Frederick.

This issue is just one of many which shall be commented on to your agency on or before February 25th. I am taking this opportunity, however, to advise you of this discrepancy so that alternatives may be at hand for the meeting of February 13th.

Yours very truly,

205

JAN 21 1980

Gerald R. Armstrong
Gerald R. Armstrong, President

cc: Mr. Wes Wilson

Bw-Info
cy: RA, DRA, MO

608 EMPIRE BUILDING, 430 SIXTEENTH STREET • DENVER, COLORADO 80202 • (303) 573-9655

RESPONSE:

1. Negotiations between Rocky Mountain Fuel Company and Northglenn are the responsibility of Northglenn.
2. The sale of this land would have to abide by existing zoning ordinances.
3. EPA recognizes that the value of land adjacent to a tailwater control pond could decrease.
4. No response is necessary.

THE ROCKY MOUNTAIN
FUEL COMPANY

January 17, 1980

Mr. Wes Wilson
United States Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Dear Wes

1 Holly Hall has advised me that you believe the location of the Standley Ditch may be moved to the east of this company's property.

RESPONSE: 1. Initial discussions with Northglenn's engineers indicated that relocation of the Bull Canal is not feasible. This option of solving the tailwater problem has been dropped from further consideration.

So long as this company owns its FRICO shares, it has rights to the water from its current location.

Neither Northglenn, Thornton, or FRICO has sought our consent to this nor has any entity made any offer to purchase or exchange our shares.

Wes, by this time you should realize that Northglenn's representations are not, in fact, performance.

Concerning the proposed tailwater pond, please review the enclosed copy of my letter to Roger Williams.

Yours very truly

Gerald R. Armstrong
Gerald R. Armstrong, President

Enclosure

JAN 18 1980

608 EMPIRE BUILDING, 430 SIXTEENTH STREET • DENVER, COLORADO 80202 • (303) 573-9655

United States Department of the Interior
NATIONAL PARK SERVICE
ROCKY MOUNTAIN REGIONAL OFFICE
655 Parfet Street
P.O. Box 25287
Denver, Colorado 80225

IN REPLY REFER TO
L7621 (RMR)PC

25 JAN 19[illegible]

Mr. Roger L. Williams
Regional Administrator
United States Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

1 The National Park Service has reviewed the draft environmental impact statement for the Northglenn Water Management Program, City of Northglenn, Colorado. We support Northglenn's attempt to manage their water so as to retain much of the land historically irrigated.

RESPONSE: 1. Acknowledge

Sincerely yours,

for Richard A. Strait
Associate Regional Director
Planning and Resource Preservation

JAN 29 1980

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION VIII
FEDERAL OFFICE BUILDING
19TH AND STOUT STREETS
DENVER, COLORADO 80294

January 30, 1980

FEB 1
[illegible]

Mr. Roger L. Williams
Regional Administrator
United States Environmental
  Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

1 The Draft Environmental Impact Statement, Northglenn Water Management Program, City of Northglenn, Colorado, has been reviewed by the Public Health Service in Region VIII. No comments will be submitted at this time.

Sincerely yours,

Hilary H. Connor, M.D.
Regional Health Administrator

RESPONSE: 1. Acknowledge

②

City Hall
City of Thornton

8992 N. Washington Street
Thornton, Colorado 80229
303/ 288 580

January 31, 1980

2415

Mr. Roger L. Williams
Regional Administrator
United States Environmental
   Protection Agency
Region VIII
1860 Lincoln Street
Denver, CO   80295

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EPA REGION VIII
Water Division

Dear Sir:

The City of Thornton Utilities Board and City Council would like to take this opportunity to formally comment on the draft environmental impact statement regarding the proposed Northglenn Water Management System. Although we do not take exception to the management plan, we are concerned about certain statements about the level of service provided to Northglenn by Thornton.

1 There is an overriding concern about the quality of Thornton's finished water. It can be implied from the report that Thornton's water is in some way unsafe or unpotable. The City of Thornton's water supply currently meets or exceeds EPA Safe Drinking Water Standards. Planned improvements to our treatment process and raw water supply system ensure that Thornton will continue to meet the EPA standards.

2 There are also some comments in the plan regarding the ability of Thornton to adequately serve the City of Northglenn either now or in the future. The City of Thornton presently has the ability to serve the City of Northglenn and is capable of doing so in the future. The reason for the City of Thornton entering into a severance agreement with the City of Northglenn was not because of any stated need by the City of Thornton, this agreement was entered into only to accommodate the desires of our sister city. Thornton has the necessary plant and water resources to adequately serve the City of Northglenn. Enclosed is a letter from Mr. Wesley R. Brown, Chairman of the Thornton Utilities Board, to then Mayor-elect Odell Berry stating Thornton's continued willingness to serve.

Orig BW
cy: RA DEA, WD

The City of Planned Progress

RESPONSE:

1. EPA did not intend to imply that current water quality of Thornton's water supply is unsafe. As stated in the draft EIS (page 15) Thornton has corrected previously identified water quality problems.

2. EPA review indicates that Thornton must expand its water resources system in order to adequately serve the future growth of both Thornton and Northglenn. Engineering analysis of the necessary water resources has not been completed by the City of Thornton. See water supply alternative analysis.

Mr. Roger L. Williams
Page Two
January 31, 1980

We of the Thornton Utilities Department welcome the opportunity to further detail our views regarding the Northglenn Water Management Plan. The Utilities Department staff is presently conducting an in-depth review of the Environmental Impact Report and will make their factual correction available to your staff.

Sincerely,

Wesley R. Brown, Chairman
Utilities Board

Margaret W. Carpenter

Margaret W. Carpenter
Mayor

WRB, MRC/bs

Enclosure

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
REGIONAL/AREA OFFICE
EXECUTIVE TOWER - 1405 CURTIS STREET
DENVER, COLORADO 80202

REGION VIII

January 31, 1980
24096

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EPA REGION VIII
Water Division

Mr. Roger L. Williams
Regional Administrator
U.S. Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

Thank you for the opportunity to review the draft Environmental Impact Statement (EIS), "Northglenn Water Management Program, City of Northglenn, Colorado."

Your draft EIS has been reviewed with specific consideration for the areas of responsibility assigned to the Department of Housing and Urban Development (HUD) for review of other agencies' EISs. These areas focus upon a proposal's compatability with local and regional comprehensive planning and impacts on urbanized areas.

Your draft EIS failed to discuss the long-term impacts which the proposal
may have upon the health of the affected urban population. Consideration
1 should be given to the possibility that a change in the existing ground water
table could cause any section of the Bull Canal proposed for sewage water flow
to leak nitrates into the ground water supply. Lining such a section might
2 act as a mitigation. Also, the odor and safety hazard associated with the
sewage water flow in the Canal should be better described. Possible mitigation
could include fencing along with a suggested minimum distance to any proposed
residential units. The radiological and chemical hazards associated with the
Rocky Flats Nuclear Facility should be discussed in relationship to the present
3 and possible contamination of the Standley Lake water supply, including what
safety measures will be taken in the event that a sudden contamination of this
water supply occurs.

We appreciate the opportunity to review and comment on this draft EIS. If you have any questions regarding these comments, please contact Mr. Carroll F. Goodwin, Area Environmental Clearance Officer, at (303) 837-3102.

Sincerely,

Raymond D. McKinney
Raymond D. McKinney
Director
Program Planning and Evaluation

orig: EW - info
cy: RA, DRA, MO

AREA OFFICE
Denver, Colorado

RESPONSE:

1. While not part of this project, FRICO has undertaken the lining of the Bull Canal. This independent action will reduce any potential problems related to groundwater contamination.

2. EPA has considered fencing as an alternative safety hazard mitigation. It was concluded that fencing was not as effective a mitigation measure as treatment controls. EPA has recommended controls of pathogenic indicators at the treatment facility. These controls have been accepted by Northglenn. Local governments can consider fencing or provide an additional buffer zone.

3. EPA recognizes the potential for radiological contamination of Standley Lake by the Rocky Flats Nuclear Facility as was discussed in the draft EIS (pages 141-142). Safety measures taken by Northglenn, in the event contamination should occur, will be in accordance with the State administered Radiological Emergency Response Plan for Rocky Flats.

DEPARTMENT OF THE ARMY
OMAHA DISTRICT CORPS OF ENGINEERS
6014 U.S. POST OFFICE AND COURTHOUSE
OMAHA NEBRASKA 68102

MROED-DK

5 February 1980

Mr. William H. Hormberg
Director, Office of Grants
United States Environmental
Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Hormberg:

This is in response to your letter dated 18 January 1980 requesting our opinion of the natural clay liner proposed for the wastewater storage reservoir at Northglenn, Colorado.

Your concern over the leakage potential of a 6-inch clay layer is valid but, in our opinion, the intent of the specifications is to provide an effective liner well in excess of six inches. Granular material or fractured materials encountered in the reservoir bottom must be removed and replaced with two feet of compacted select impervious materials. For other areas, the top six inches is to be scarified and recompacted to at least 95 percent of maximum density. We believe this procedure will provide a permeability in the 6-inch blanket of less than 10^{-6} cm/sec if the surface soils are clays. The overall leakage will not present a problem if, immediately below the 6-inch recompacted layer, the soils are relatively impervious as indicated in the soils report.

1 Our primary concern is the possibility of a relatively thin (six inches or less) layer of impervious material over pervious material which would not be apparent from either a visual inspection of the prepared bottom or examination of the existing soil boring data. Therefore, it is essential that close inspection and testing of the soils which form the bottom be conducted and approved by a soils engineer. The risks associated with isolated thin layers of impervious materials would be compounded if the bottom surface is allowed to dry and crack. We suggest a requirement for keeping the surface moist after it has been constructed to preclude this from happening.

RESPONSE:

1. EPA acknowledges the potential risks of not providing an impervious seal. Northglenn will be required to include inspection and testing of soils, and assure proper soil moisture content during construction.

MROED-DK
Mr. William H. Hormberg

5 February 1980

The soils reports and preliminary environmental report furnished with your 18 January 1980 letter are inclosed.

Sincerely,

R. G. BURNETT
Chief, Engineering Division

2 Incls
1. Soils Reports
2. Prelim Environ Report

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FEB 11 1980

western union **Telegram**

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PMS ROGER WILLIAMS ADMINISTRATOR CARE REGION VIII ENVIRONMENTAL PROT, A
LF
1860 LINCOLN ST
DENVER CO 80295

1 THE MCPTHOLEN WASTEWATER IRRIGATION PROJECT HAS RECEIVED NATIONAL ATTENTION AS IN INNOVATIVE EXAMPLE OF COOPERATION BETWEEN CITY AND FARM AND AS AN ENERGY EFFICIENT WAY TO RECYCLE EFFLUENT BACK TO THE LAND. AT A CRITICAL TIME IN OUR NATIONS HISTORY WHEN WE NEED NEW WAYS TO SOLVE PROBLEMS OF POPULATION GROWTH AND SCARCE RESOURCES, WE ASK YOU TO LET THE KOPTHOLEN WATER MANAGEMENT PROGRAM PROCEED WITH A MINIMUM AMOUNT OF RE-STUDY AND DELAY THANK YOU

JEROME GOLDSTEIN EDITOR COMPOST SCIENCE/LAND UTILIZATION EMMAUS PA

RESPONSE: 1. Acknowledge

DAVIS, GRAHAM & STUBBS
ATTORNEYS AT LAW

[illegible] COLORADO NATIONAL BUILDING
[illegible] SEVENTEENTH STREET
DENVER, COLORADO [illegible]

TELEPHONE [illegible]
TELECOPIER [illegible]
CABLE DAVGRAM DENVER

February 13, 1980

Mr. Roger Williams
Regional Administrator
Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80203

Re: Public Hearing of February 13, 1980
at the Northglenn Community Center

Dear Mr. Williams:

1 We have not yet received a response to our letter of February 12, 1980, hand delivered to your office on that same day.

We appear at these Agency proceedings of February 13, 1980, under protest and with great reservations about the Agency's intentions and its lack of compliance with the National Environmental Policy Act and the regulations of the Council of Environmental Quality pertaining to the preparation of a draft Environmental Impact Statement.

Attached hereto as Appendix 1 is our letter of February 12, 1980, pointing out that the CEQ "scoping requirements" have been intentionally and deliberately violated by the Agency.

Also attached hereto as Appendix 2 is a letter of August 21, 1979 from EPA Contractor,Engineering-Science, to the Northglenn EPA Project Officer, Mr. Wes Wilson, pointing out that a:

> "thorough evaluation of alternative water supplies for Northglenn has not to our knowledge been accomplished. In order to address the reasonableness of wastewater

RESPONSE:

1. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

> "alternatives that discharge to other than Bull Canal, at least the likelihood of developing alternate water supplies needs to be addressed".

This letter also points out that very little water rights information had been provided to the contractor by Northglenn and that changes were constantly occurring in the information being supplied by Northglenn.

Attached as Appendix 3 is a letter of October 12, 1979 from the EPA Contractor, Engineering-Science, to EPA Northglenn Project Manager, Wes Wilson, stating their conclusion that an Environmental Impact Statement should be prepared for the project under the applicable CEQ, EPA and EIS requirements. The letter proposes that an Environmental Impact Statement would be prepared using the Environmental Analysis prepared by Engineering-Science and EPA as a basis. This letter clearly points out that a draft EIS under applicable law must include an

> 'evaluation of an alternative water supply and wastewater systems", "a full scale public participation program", and "further consideration of land use implications of the project",

as well as other important issues which had not been studied in the environmental assessment.

Instead of preparing a draft EIS in accordance with the Contractor's recommendations, and in violation of CEW regulations, the Agency merely changed covers on the Environmental Assessment and issued that document as a draft EIS. This action is a clear violation of CEQ regulations which became effective on July 30, 1979 (40 C.F.R. 1506.12) and are binding on all Federal Agencies for implementing the procedural provisions of the National Environmental Policy Act (40 C.F.R. 1500.3). The CEQ regulations clearly provide that

> "draft environmental impact statements shall be prepared in accordance with the scope decided upon in the scoping process".

(40 C.F.R. 1502.9(a)). The scoping process must be undertaken after the Agency decides to prepare an Environmental Impact Statement, unless it has clearly issued notice to the public that scoping will be combined with the preparation of the Environmental Assessment. (40 C.F.R. 1501.4(2)(d)). Such was not the case here. At no time were our clients, Rocky Moutanin Fuel Company and Consolidated Ditches Company, or any members of the public notified that scoping would be coterminous with the preparation of an EIS.

According to the CEQ regulations, the alternatives consideration of a draft EIS is the "heart" of the statement"

> "it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public".

(40 C.F.R. 1502.14). This same regulation further provides that the Agency shall"

> "rigorously explore and objectively evaluate all reasonable alternatives", "devote substantial treatment to each alternative considered in detail including the proposed action", "include reasonable alternatives not within the jurisdiction of the lead agency", and "include the alternative of no action".

(40 C.F.R. 1502.14(a)-(d).

The requirements of NEPA and CEQ state that the purpose of the NEPA process is to study the

> "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented"

(40 C.F.R. 1502.16).

The purpose of the scoping proceedings is to

> "determine the scope and the significant issues to be analyzed in depth in the environmental impact statement".

(40 C.F.R. 1501.7(a)(2).

As clearly demonstrated from the correspondence of EPA's contractor, the Environmental Assessment (now ludicrously called a Draft Environmental Statement) does not contain a discussion of alternatives to the Northglenn project, either water supply alternatives or wastewater treatment alternatives.

As noted on page 16 of the "draft EIS","in effect, Northglenn's wastewater treatment need is entirely a function of the water supply and exchange project,"which Northglenn has chosen to pursue with the Farmers Reservoir and Irrigation Company (FRICO).

The failure to study alternatives to the Northglenn project is even more shocking in view of the Agency's statement on page 15 of the "draft EIS" that Thornton has developed and is developing water from outside the Denver-Metro area which will be sufficient to supply both Thornton's and Northglenn's requirements. This would preclude the drying up of a large acreage (approximately 2,000 acres) of productive, irrigated agricultural land which Northglenn will dry up under its present proposal.

The "draft EIS" notes that Northglenn has promised to return to FRICO 110% of the water it borrows from FRICO. Anyone familiar with the over-appropriation of the South Platte River System knows that water cannot be created by magic and that Northglenn's program to repay consumptive use and depletions from the stream system and pay a 10% bonus, will come at the expense of other water users unless water is brought in from another source, such as South Park or the West Slope.

In addition, it appears that Northglenn has had the temerity, with EPA support, to commence construction of its project prior to the completion of the NEPA process. Attached hereto as Appendices 4 and 5 is the two volume deposition of Richard P. Lundahl, Director of Natural Resources of the City of Northglenn. On pages 34, 35, and 36 of volume 1 (Appendix 4), Mr. Lundahl testified that EPA representatives authorized Northglenn to proceed with portions of its project. This is in direct violation of the CEQ regulations which provide that no action shall be undertaken, except for the preparation of plans and designs, that will

> "have an adverse environmental impact" or "limit the choice of reasonable alternatives".

(40 C.F.R. 1506.1(a)(1)(2)). This same regulation states that, when the Agency becomes aware that an applicant is taking an action which either has an adverse environmental impact or limits the choice of reasonable alternatives, the Agency shall promptly

> "notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved".

(40 C.F.R. 1506.1(b)).

It appears that EPA, in violation of law, has encouraged Northglenn to commence construction of facilities which will commit Northglenn to implementing the proposed Northglenn project at the same time that the Agency is required by law to study all alternatives, including the no action alternative.

The CEQ regulations state that "environmental impact statements" shall serve as the means of assessing the environmental impact of proposed agency actions, rather the justifying decisions already made." (40 C.F.R. 1502(g)). Mr. Lundahl's testimony in volume II of his deposition clearly shows that the City of Northglenn did not pursue application to the Denver Water Board to supply Northglenn with its water needs, nor has it pursued having Thornton continue to supply its needs, nor has it studied any other means for supplying water to the City of Northglenn other than through the FRICO Exchange.

By its actions in allowing Northglenn to commence construction on facilities which implement the FRICO Exchange, the Agency is limiting the choices of reasonable alternatives to the Northglenn project and is allowing needless adverse environment impacts to occur. It is clear that the proposal to build the wastewater treatment facility in Weld County, for which EPA funding is sought, is tied inextricably to the FRICO Exchange, because this is the means by which the "borrowed" water will be returned to FRICO.

We reserve the right to submit further written comments which more fully elucidate our position. However, at this time, we are requesting the following actions from you, in your capacity as Regional Administrator of the Environmental Protection Agency:

1. That you consider this February 13, 1980 proceeding as a scoping proceeding under the requirements of the CEQ regulations.

2. That you order preparation of a draft Environmental Impact Statement based upon this scoping proceeding and all other available information.

3. That you inform Northglenn immediately that it cannot construct any feature of the Northglenn Water Management Program until the NEPA process has been completed, and agency decision and record of agency decision has been prepared in compliance with NEPA, CEQ and EPA requirements.

4. That you issue an order to Northglenn instructing it to cease construction of any aspect of the Northglenn Water Management Program which is now under construction, and that you petition the Court to obtain curtailment of any such construction, if Northglenn chooses to proceed with construction of any aspect of its Water Management Program during the pendency of the NEPA process.

Our clients are willing to cooperate with the Agency study and believe that the above actions are necessary and will demonstrate the good faith of the Agency, if undertaken.

Sincerely,

Gregory J. Hobbs, Jr.
for
DAVIS, GRAHAM & STUBBS

GJH Jr/hm

Enclosures

[illegible]

DAVIS, GRAHAM & STUBBS
ATTORNEYS AT LAW

[illegible] COLORADO NATIONAL BUILDING
[illegible] SEVENTEENTH STREET
DENVER, COLORADO [illegible]

TELEPHONE 303 [illegible]
TELECOPIER 303-[illegible]
CABLE DAVGRAM, DENVER

[illegible]

February 12, 1980

Mr. Roger Williams
Regional Administrator
United States Environmental
  Protection Agency
1860 Lincoln Street
Denver, Colorado 80203

Dear Mr. Williams:

Our clients, Consolidated Ditches Company and Rocky Mountain Fuel Company, were quite distressed at the issuance of a draft Environmental Impact Statement for the Northglenn project at the same time that the Notice of Intent to Prepare an Environmental Impact Statement was issued. Since March of 1979, our clients have expended a great deal of time, effort and expense in attempting to convince the Agency that an Environmental Impact Statement should be prepared, in accordance with law, for the Northglenn project.

1 The regulations of the Council of Environmental Quality which became effective in July of 1979 are binding on all Federal Agencies, including the Environmental Protection Agency, and require that the Notice of Intent to Prepare an Environmental Impact Statement be followed by a "scoping" proceeding whereby interested parties and the public have an opportunity to comment on the issues to be studied in a draft Environmental Impact Statement, 40 C.F.R. 1500.1 et. seq., and, in particular, 40 C.F.R. 1501.7 et. seq.

The purpose of these regulations is to formulate a draft Environmental Impact Statement which is responsive to the issues and alternatives to the project which members of the affected public perceive as germane to the Agency's study and analysis of the proposed project. Our clients have hired technical consultants in the water quantity and

Appendix 1

RESPONSE:

1. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

water quality area to advise them, and the Agency, on matters which should be studied in a draft Environmental Impact Statement. Our clients have also requested that Northglenn and the Environmental Protection Agency make available all information they have which bears on the project. This information is still being gathered and analyzed by the consultants our clients have hired.

Our clients are being deprived of the time which the CEQ regulations contemplate will be allowed for preparation of comments on a draft Environmental Impact Statement following the scoping proceeding. In fact, the draft Environmental Impact Statement for the Northglenn project is no more than the environmental assessment with a new cover and a proposed decision. We cannot understand why the Agency is in such a rush to avoid issuing a draft Environmental Impact Statement in accordance with the CEQ regulations. We believe that we should have the opportunity to comment on a draft Environmental Impact Statement which has been prepared following proper scoping.

I met with my clients yesterday, and they have authorized me to state to you that they are willing to consider the meeting of February 13, 1980 at the Northglenn Community Center as a "scoping" proceeding, and are willing to waive their claim that a new Federal Register Notice be prepared giving notice of a scoping proceeding, if you are willing to order the preparation of a draft Environmental Impact Statement for public comment responsive to the issues raised at the February 13th meeting.

We formally ask that you make this decision at this time and that your representative announce at the opening of the February 13th meeting that the proceeding will be in the nature of a "scoping" meeting and that a draft Environmental Impact Statement will be prepared for public comment which is responsive to the issues raised at this meeting.

Sincerely,

Gregory J. Hobbs, Jr.
for
DAVIS, GRAHAM & STUBBS

GJH Jr/hm

ES

ENGINEERING-SCIENCE

2785 NORTH SPEER BOULEVARD • DENVER, COLORADO 80211 • 303/455-4427

August 21, 1979

Mr. Wes Wilson
Project Officer
U.S. EPA, Region VIII
1860 Lincoln Street
Denver, CO 80211

SUBJECT: NORTHGLENN EA

Dear Wes:

Pursuant to recent discussions this letter is to summarize the status of the subject project relative to problems encountered in preparation of the Environmental Assessment.

As we have indicated, since beginning work on the project, we have continually encountered unanticipated problems such as lack of data, discrepancies in information, identification of unanticipated issues and problems to be addressed, and the need to develop data that,at the start, was assumed would be available.

The cumulative effect of these problems is that it is currently unlikely that a complete Environmental Assessment adequately addressing the issues outlined in our DOW can be prepared by 6 September 1979. We further note that recently a number of related issues have been identified that in our opinion should be addressed.

Below is a listing of some of the problems we have encountered to date and the unanticipated issues that have been identified.

1. Method to be used in preparing cost effective analyses has not been determined. The problem revolves around innovative - alternative technology guidelines and multiple purpose vs single purpose projects.

2. We have yet to receive a complete water rights augmentation plan to review. We have a draft document but changes are continually occurring. Of particular concern is that the plan does not include specific information relative to how the South Platte will be protected.

3. A recent problem with use of Bull Canal water in the City of Dacono for landscape irrigation was discussed. To date we do not have a definitive proposed resolution of this problem from Northglenn.

4. We understood that operational studies for Standley Lake have been conducted that determine the yield. To date we have not received this information.

5. We implemented a water quality sampling/analysis program with lab testing conducted by USGS. The data from USGS will not be available until at least mid-September. We are thus preparing water quality analyses on a very limited data base (one sample in some cases).

6. A potential problem with water supply in a dry year to FRICO users upstream of the point of return of the Northglenn wastewater has been identified.

   Based on current information, there will not be enough water to supply their needs. This effects approximately 25 percent of the FRICO-Standley Lake farmer shareholders.

7. Thorough evaluation of alternative water supplies for Northglenn has not to our knowledge been accomplished. In order to address the reasonableness of wastewater alternatives that discharge to other than Bull Canal, at least the likelihood of developing alternate water supplies needs to be addressed.

8. Particularly in the area of water rights and augmentation, there is no single report or final document that can be considered a complete and accurate information source. Most information we have to date has been taken from working documents. Also because of the changing nature of the information and our current schedule we are unable to adequately check or verify the numbers.

Because of the above, it is now apparent that a thorough assessment addressing all the major issues for the Northglenn project cannot be completed by 6 September 1979. We can by that date have a document that will identify issues and for many of them be essentially a status report with unresolved problems and an indication regarding recommended additional work.

Please contact us if you have any questions or comments.

Very truly yours,

Allan L. Udin
Denver Office Manager

ALU/hjh

ES

ENGINEERING-SCIENCE

2785 NORTH SPEER BOULEVARD · DENVER, COLORADO 80211 · 303/455-4427

October 12, 1979

U. S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, CO 80203

Attention: Mr. Wes Wilson
Project Officer

SUBJECT: NORTHGLENN ENVIRONMENTAL ANALYSIS

Gentlemen:

We are pleased to transmit herewith five copies of the Draft Environmental Assessment (EA) for the Northglenn Facilities Plan. The work has been conducted pursuant to Directive of Work No. 8 dated 31 May 1979 of our contract No. 68-01-4611.

The EA analyzes the proposed plan and certain options thereto. The direct and indirect impacts of the plan have been analyzed based on the plan status as provided by the City of Northglenn and their consultants. Where data were not available or still in the developing stage, appropriate assumptions have been made.

Most of the basic recommendations developed in negotiations between Northglenn, EPA and ES have been incorporated into the EA. These include coliform discharge standards, provisions for protection of public health, programs for protection of agriculture, and consideration of irrigation of raw edible food crops with effluent. Some significant project elements were not evaluated either because information was not available, or the analysis was outside of our scope of work. Examples of these include monitoring program and plant process analysis.

Based on the work performed on this EA it is our recommendation that an Environmental Impact Statement (EIS) be prepared for this project. This recommendation is based on the proposed rules of the EPA for Implementation of Procedures on the National Environmental Policy Act as they appeared in the Federal Register on June 18, 1979. Therein an EIS is required when "The environmental impact of the treatment works is likely to be highly controversial". In our opinion this project clearly warrants

appendix 3

an EIS under this criterion. Other criteria presented in the proposed rules including ". . .adversely affect significant amounts of prime agricultural land. . ." and ". . . adverse effect upon. . .surface or groundwater quality or quantity. . ." may indicate the need for preparation of an EIS for this project.

An EIS would use the enclosed EA as a basis. There are several other elements that must be included to fulfill the CEQ and EPA EIS requirements. These include:

1. In-depth analysis of the economic impact of the proposed project including more detailed cost effectiveness analysis;
2. Evaluation of the proposed treatment process regarding reliability and flexibility;
3. Evaluation of an alternative water supply and wastewater systems;
4. Evaluation of long term impacts of use of non-tributary deep aquifer water;
5. Further consideration of land use implications of the project;
6. Further resolution of inter-agency problems;
7. Full scale public participation program; and
8. Resolution of legal issues associated with water rights and augmentation.

In conclusion, we are pleased to have the opportunity to work with you on this interesting and challenging project. We will prepare the final document when we receive your comment.

Very truly yours,

Allan L. Udin
Denver Office Manager

ALU/bjh

Enclosures

February 11, 1980

Office of the Mayor

Mr. Roger L. Williams
Regional Administrator
Environmental Protection Agency
1860 Lincoln Street, Suite 900
Denver, Colorado 80295

RE: Environmental Impact Statement on
Northglenn Water Management Plan

Dear Mr. Williams:

On behalf of the City of Westminster, I wish to take this opportunity to reflect the City of Westminster's position and thinking on the Environmental Impact Statement pertaining to the Northglenn Water Management Plan. We appreciate the opportunity to share our thoughts and observations on this water plan in the public hearing which your agency has scheduled for Wednesday night, February 13, 1980.

1 As your office is fully aware, the City of Westminster has been in the utility business for many years and became the lead agency for wastewater treatment in our City in 1970 when the Westminster Sanitation District was dissolved. Subsequent to this vote of the people, the City embarked upon the initial 1.0 MGD construction of the Big Dry Creek Wastewater Treatment Plant located at 132nd Avenue and Huron Street. We have worked closely with the Denver Regional Office of EPA in pursuing needed expansions to the treatment capacity at the Big Dry Plant and have been able to plan such expansions in advance of the needs occurring in the Big Dry Creek Basin. We are fully cognizant of the many factors and influences which must be addressed in a water management plan such as the one which the City of Northglenn is presently pursuing. From our experience, we can readily conclude that establishing water and wastewater utility services for a growing population is an ongoing challenge and commitment for elected city officials, professional staff members, consulting engineers and water attorneys. We must be in harmony with the environment and the agricultural

-continued-

3031 West Seventy Sixth Avenue • 80030 • 303 429-1546

RESPONSE: 1. Acknowledge

community as we pursue design and construction of needed infra structure, treatment plants as well as assuring dependable raw water resources.

1 The City of Westminster joined hands with the Cities of Northglenn and Thornton and the Farmers Reservoir and Irrigation Company last May in an historic cooperative venture which was signed and executed in the presence of Governor Richard Lamm. This historic document is a bold indication to the public and to governmental entities such as the Environmental Protection Agency that cities can work in harmony on utility matters and at the same time work in a cooperative spirit with the agricultural community. I am certain you are fully aware of the many components of the Four-Way Agreement which we executed in 1979 and I, therefore, will not go into the details of the agreement. This agreement has paved the way for the three cities to realize valuable capacities and capabilities in carrying out their respective utility plans. City officials representing the three respective cities worked hard in frank and open negotiations over several months starting in the late fall of 1978 to hammer out this cooperative agreement. The terms of it provide the vehicle for Northglenn to achieve a dependable water supply through the cooperative venture with the Farmers Reservoir and Irrigation Company. The three cities stand ready to maximize the utilization of the Standley Lake Reservoir to assure reliable water service to our individual constituencies.

All of us are called upon to use our imagination and implement innovative techniques to achieve water service for Denver metro area residents. This is especially true in semi-arid, water short Colorado. It is prudent on the part of governmental officials to pursue to the fullest extent possible successive use programs utilizing limited water resources as many times as possible prior to the water leaving the State of Colorado. Further, we are called upon to achieve as much storage capability as possible to store our water resources when the bulk of the water is available in the spring time with the seasonal run-off. The Northglenn Water Management Plan addresses such key factors and should be looked upon appropriately by the Environmental Protection Agency. Petty politics and narrow minded thinking must be set aside in resolving the remaining concerns with their plan.

We appreciate the opportunity to provide input in this public hearing which the Environmental Protection Agency is conducting.

Very truly yours,

Vi June
Mayor

February 11, 1980

Gentlemen:

My name is Joseph D'Orazio. I've been a resident of Frederick since 1925. In that time I've served as a Volunteer Fireman for 32 years, 15 of those years a Fire Chief, and I put in 12 years as a Town Councilman. I have always given my best efforts in behalf of furthering the progress of our town.

During the last 25 years I feel the town of Frederick has made excellent progress, despite several natural and man made disasters that hit our town. First, we were the victims of two floods - one in 1938 that wiped out our water works, and a second, larger flood in 1961 that caused great damage to most of the homes in town. The Bull Canal was one of the main causes of both these floods.

Canal

Our man made disaster concerns the loss of our high school from 1962 until this year. A high school is the life blood of a community. The Tri-Town area was a sterile area without the high school. This year we opened the new Frederick High School. It has become a point of pride and a center of activity for our area. The school buildings are situated directly in the path of the past floods that inundated our town.

These misfortunes that beset our area have been solved. They were not, of course, permanent. I do feel, however, that the building of a sewage disposal plant so close to the Tri-Town area would be a permanent disaster of greater impact on us than anything we've faced before. The effect of this proposed plant on our economy would be immense. Who would want to invest in an area that suffered from periodic bouts of odor from the plant? 1

The EPA's Draft Environmental Impact Statement admits that there is nothing that can be done about the odor under certain conditions. Can you imagine a school full of students trying to study while being subjected to the stink produced by the wastes of the people of Northglenn? Perhaps if the plant were located much closer to Northglenn - say on Grange Hall Creek - perhaps the good citizens of Northglenn would have a greater interest in the amount of stench produced by their disposal plant.

I can't understand how the EPA can approve of a plan that would take clean water from an irrigation ditch, contaminate this same water with human and industrial waste, and then allow this waste water to be dumped back into the same irrigation ditch thereby polluting any Standley Lake water sent down the Bull Canal without going through the Northglenn. An irrigation ditch is not a free flowing river.

RESPONSE:

1. Based on analysis conducted by EPA's consultant it has been concluded that odors that may potentially be generated from Northglenn's wastewater treatment plant or storage reservoir are not likely to drift six miles and create an impact on the community of Frederick.

2 The EPA has admitted that at times the flow in the ditch will consist purely-if I can use that term- of effluent. But I haven't read anything in the Impact Statement about how the city of Northglenn is going to keep the irrigation ditch open during the winter months.

3 The proximity to Northglenn of the South Platte River which is being used now as a conveyor of waste water certainly raises the question of why the EPA is not considering this solution to Northglenns problems. Northglenn could obtain the FRICO water rights by purchase or condemnation and build it's plant so that the effluent is dumped into the South Platte. If the waste water is so treated and purified to make it usable to irrigate crops, the effluent could be put in the South Platte without despoiling the water there.

4 The threat of floods still hangs over our town. The type of thunderstorms we have in Colorado dump huge amounts of water in a small area. Sooner or later one of these storms will be centered over the proposed plant and lagoons. The Bull Canal will bring the flood waters into the Tri Town area as has happened before. Then the people of our area will be wallowing in flood waters contaminated with the wastes of the people of Northglenn. Why should we be subjected to the possibilities of this happening to us when there are alternative answers to Northglenn's problems that won't subject others to the potential problems of the air and water pollution that would arise from the plan to put the plant in Weld County. The Option Number Four presented in the Impact Statement would solve all our potential problems and also solve Northglenns problems.

I respectfully ask that the Region VIII Office of the EPA disapprove the proposed project of the Northglenn Water Management Program.

Sincerely,

Joseph D'Orazio

2. The operation of Northglenn's wastewater treatment facility and storage reservoir will be such that no discharges will occur into the irrigation ditch during the winter months. Discharge is only to occur during the irrigation season and will be primarily confined to late spring and summer.

3. EPA has considered the option of Northglenn discharging into the South Platte River. This option which would entail Northglenn continuing to be provided wastewater services by the Denver Metro facility is evaluated and presented in detail in the Environmental Impact Statement.

4. EPA believes that sufficient capacity in Northglenn's storage reservoir will prevent the introduction of wastewater into the Bull Canal during flooding events.

February 12, 1980

Mr. Roger L. Williams
Regional Administrator
U.S. Environmental
Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

1 Pursuant to the Notice of Public Hearing concerning the Draft Environmental Impact Statement of the Northglenn Water Management Plan, the following comments are provided by the Town of Frederick. In summary, the Town of Frederick is greatly concerned about the adverse impacts the proposed project will have on the Town of Frederick and the surrounding areas, and as such is firmly opposed to its construction.

In connection with the Draft Environmental Impact Statement, the following comments are provided in a numbered sequence for ease of reference.

2 1. Page 3. It is stated that the integrated approach to resource management is predicated on the following factors:

"1) Northglenn's stated need to provide an adequate source of water for its users through the year 2000."

We wish to point out that Northglenn presently has a water source and according to the City of Thornton, which provides their water service, the supply is adequate both in quantity and quality. It does not appear that Northglenn has addressed this very basic issue in a manner which would substantiate this claim. If the City of Thornton claims that the supply is adequate and the City of Northglenn disagrees, it should be a requirement that Northglenn provide sufficient evidence as to their claim that they do not have an adequate source of water through the year 2000.

3 2. Page 6. Items 4) and 5) of the proposed EPA Decision are stated as follows:

"4) there are no significant direct adverse environmental effects of the proposal other than a potential odor problem at the treatment site;

5) assuming the Bull Canal is currently suitable as a domestic raw water source, if the proposal is implemented

RESPONSE:

1. EPA acknowledges that the Town of Frederick is opposed to the construction of Northglenn's wastewater treatment facility.

2. EPA has conducted an alternative water supply analysis in addition to the proposed FRICO exchange. Presented in Chapter 3 is a description of the water supply alternatives considered and presented in Chapter 4 are their associated environmental impacts.

3. Sewage effluent will be prevented from entering the streets of Frederick under provisions of the tailwater control plan. Frederick does not currently own water rights along the Bull Canal nor have they requested a water supply designation of the canal.

> Bull Canal will no longer be suitable as a source of domestic raw water, due to nitrate concentrations. EPA concludes that since the Canal is not presently used for a domestic water supply, nor has there been any formal request to designate the canal for domestic water supply, there is no need to protect the canal for water supply;"

3 The Town of Frederick greatly disagrees with the statement numbered 4). We certainly believe that there are significant direct adverse environmental effects other than the potential odor problem at the site, namely, the condition of having sewage effluents from irrigation tailwaters run through and adjacent to the high school grounds, junior high school grounds, and residential streets in the Town of Frederick; and the fact that the Bull Canal will no longer be suitable as a source of domestic raw water, which source has been planned for use by the Town of Frederick and is needed for the future development thereof.

3. Page 7. Item 2 states "Prevention of agriculture tailwater runoff into the Towns of Frederick and Firestone."

> "Present agricultural practices combined with a lack of proper storm water drainage allows runoff to flow through these communities. Northglenn will be required, at their expense, to intercept and control these flows in order to further reduce public contact with tailwater runoff (treated sewage effluent)."

4 At the present time, Frederick is not aware of any plans to intercept and control the flow of the treated sewage effluent from the tailwaters of the irrigated lands. It is stipulated in other parts of the EIS that holding ponds are contemplated which would provide some control, but would not completely eliminate the situation of wastewater being conveyed through the school grounds and residential streets of Frederick. The proposal of constructing holding ponds would mean that these facilities would have to be constructed in the prime residential areas which in themselves would pose a condition which would be unacceptable from a health point of view. Additionally, the construction of holding ponds within the prime residential areas or areas which are planned as prime residential areas would have significant adverse impact upon the development of the future residential sites within the Town of Frederick. In other words, ponds containing wastewater effluent would now occupy those vacant lands which are directly across the street from existing residential areas and would also displace future planned residential construction in these areas.

4. The purpose of the tailwater control plan is to provide a degree of control over wastewater used in irrigation of lands adjacent to the existing communities of Frederick and Firestone. It is recognized that these ponds will be temporary in nature as urbanization of these two communities to the east occurs. It is expected that as the urbanization occurs, the amount of land irrigated will gradually decrease therefore eliminating the need for tailwater control. EPA does not believe that as prime residential areas develop that the tailwater control ponds will be restrictive to this development. It is likely that as development occurs and irrigation continues on undeveloped land that the tailwater control plan collection system will be modified and protect the public from coming into contact with the irrigation wastewater.

5

4. Page 10. It is stated that "Protection for Drinking Water Supplies is not Necessary."

> "The Bull Canal is not currently used for a domestic water supply and there has not been any petition to the State to designate this source for domestic use. Based on very limited data, it does appear the Bull Canal is currently suitable for a domestic raw water supply. The Town of Frederick indicated to EPA they intended to use water from the Bull Canal to augment their present surface supplies. The Town of Ft. Lupton has informed EPA of its intention to use San Hill Reservoir which receives some flow from Bull Canal as their future domestic water supply source."
>
> "The concentration of nitrates in the canal could adversely affect such plans since the concentration will exceed the National Drinking Water Standard of 10 mg/l. Water containing such high concentrations of nitrates is not economically suited as a domestic source. EPA recognizes that this change in water quality potentially represents a resource lost. EPA concludes that: 1) Bull Canal discharges to Sand Hill Reservoir are insignificant to the total inflow and, therefore, this proposal should not adversely affect Ft. Lupton's intended use of this source and 2) the Town of Frederick should seek other available sources for a domestic supply."

The Town of Frederick strongly disagrees with this statement. The Town of Frederick fully intends to use the waters of Bull Canal for future domestic raw water supply. The water quality presently in Bull Canal is suitable for this purpose. There are presently 760 acres of prime development land located within the existing Town limits of Frederick. These lands were annexed with the condition that they are obligated to provide the Town with 1 1/2 acre feet of water for every acre of land developed. This would mean that of the 760 acres, there is a 1140 acre feet water commitment to the Town of Frederick. It has been Northglenn's and EPA's position that in connection with the future water supply for these undeveloped lands the Town will simply have to look elsewhere. This is not an acceptable solution to the Town of Frederick and at a very minimum Northglenn should be required to protect at least the 1140 acre feet of water from contamination from wastewater effluent in order to insure that this water will be available for future use by the Town of Frederick.

5. Refer to response to Item 1. In reference to EPA's anti-degradation policy EPA believes that the current use of the Bull Canal water and Standley Lake water is for agricultural purposes. EPA further recognizes that Northglenn has adequately demonstrated that the wastewater to be discharged into the Bull Canal likewise is suitable for irrigation of crops except raw edible vegetables.

5 Further, it would appear that allowing the intentional degradation of the quality of the water in the Bull Canal is contra to the water quality policy of EPA and the State of Colorado. First, EPA's "Guidelines for State and Areawide Water Quality Management Program Development" require that water quality use classifications be established to protect the highest use attainable. EPA's position that the Bull Canal may be degraded because it is not presently used as a water supply appears to contradict EPA policy of protection of existing quality. EPA also has required that States develop and adopt an antidegradation policy. See 40 CFR 130.17(e). The position taken in this EIS concerning the degradation of the quality in the Bull Canal appears to be inconsistent with this policy.

The position that the Bull Canal may be degraded also appears contra to the policy of the State Water Quality Control Commission. The Commission has adopted an antidegradation standard (See 3.1.8). It has also taken the position that waters should be classified for the highest water quality attainable (See 3.1.6(1)(3). The intentional degradation of water in the Bull Canal that is now suitable for water supply appears to be inconsistent with these policies of the Commission.

6 If the anticipated degradation of the Bull Canal by Northglenn is allowed by EPA, the Town of Frederick believes it should be compensated for this degradation similar to the way that Northglenn has offered to compensate farmers who may grow edible crops with the Northglenn effluent. This compensation scheme is discussed on pages 89 and 90 of the EIS. In summary, it recognizes that there were no raw edible food crops grown in the FRICO Standley Lake system at this time but because there is a potential for these crops to be grown in the future Northglenn has agreed to assist farmers in marketing such crops or to purchase the crops if necessary. The situation concerning use of the Bull Canal as a public water supply is quite similar. The Bull Canal has not in the past been used as a water supply by Frederick. However, in view of the Town's water rights dedication ordinance discussed above, there is a substantial likelihood that Bull Canal water will be used in the future as a public water supply. In such event Northglenn should compensate the Town of Frederick for any cost necessary to seek the alternate water supplies that EPA suggests that Frederick use. 7 The Town of Frederick requests that EPA add a grant condition in this regard similar to the grant condition concerning compensation to farmers who raise edible crops as set forth on page 90 of the EIS.

Such a grant condition would be reasonable and justified because the expectation by the Town of Frederick of future use of the Bull

6. EPA has dropped the condition to ban the sale or distribution of raw edible food crops within the project area. Northglenn is required through its agricultural reuse manual to provide precautionary measures and instructions to the farmers relative to the use of treated effluent on raw edible food crops.

7. As stated above EPA will not establish any grant condition concerning compensation to the Town of Frederick nor does EPA intend at this time to establish any grant condition to prevent the sale or distribution of edible food crops.

Canal for domestic water supply is not mere conjecture. Frederick is presently served by the Lower Boulder Ditch which has a limited carrying capacity and is presently involved in a legal controversy over carrying water to Frederick for domestic use. Further, the quality of the Lower Boulder Ditch is less desirable than the existing quality of the Bull Canal because the Lower Boulder Ditch headgate is just below the sewage treatment outfall of the City of Boulder.

Groundwater supplies in the Frederick area are of marginal quality and quantity for municipal use principally because much of the area overlays abandoned and inactive coal mining areas. Therefore, Frederick may have no good future public water supply other than the Bull Canal. Hence, the Northglenn should not be allowed to solve its problems by causing additional problems for its neighbors. EPA should not allow the Bull Canal to be degraded as described in the EIS. At the very least, EPA should put the financial burden of any degradation of quality of the Bull Canal on Northglenn where it rightfully belongs. This should be done by the suggested grant condition.

8

5. Page 15. The fourth paragraph under the heading "PURPOSE AND NEED" states:

> "Northglenn's stated position is that the City of Thornton cannot provide an acceptable water supply, either in terms of quantity or quality. The raw water quality at Thornton's Columbine Water Treatment Plant has on occasion had nitrite concentrations that exceed the drinking water standard of 1.0 mg/l (1). Thornton indicates this problem has been corrected (2). Thornton also indicates that they are currently developing water resources outside of the Denver metropolitan area to supplement their existing water supplies. The current position of Thornton is that they can provide an adequate water supply for themselves and Northglenn (3)."

Thornton says it can meet the commitments of Northglenn and Northglenn apparently disagrees. Who is right? Surely if Thornton can meet the needs, the entire project is not necessary for the City of Northglenn. Certainly before a commitment by EPA is made to fund the project it should be necessary to fully substantiate the need therefor. It is, therefore, suggested that the City of Northglenn be required to satisfactorily demonstrate the actual need and not just take the position that the quantity and quality of Thornton's supply is not acceptable without getting proof thereof.

8. As indicated in response to other comments regarding this issue, EPA acknowledges the fact that Thornton's existing water supply is acceptable in terms of quality to satisfy current drinking water criteria. However, Thornton has not demonstrated to EPA that their water resources are adequate to provide the future water supply needs of both Northglenn and Thornton without the development of additional resources. Please refer to the alternative water supply analysis for further discussion.

9 Further, the discussion of the no action alternative contained on page 51 of the EIS appears inadequate. EPA reasons that because Northglenn says it will proceed with the project with or without federal funds that the environmental effects of funding the project are the same as not funding the project. This tactic could be used by every proponent of a federal action in which an EIS is involved in order to preclude consideration of "no action." Rather than cavalierly dismissing the "no action" issue as it has in the draft EIS, EPA should discuss the consequences of maintaining the status quo such as staying with the City of Thornton for its water supply and having its wastewater continued to be treated by Metro.

6. Pages 39 and 40. Paragraphs 1, 2, 3 and 4 under heading "POTENTIAL FOR DRINKING WATER SUPPLY" state:

> "Concern has been expressed regarding the degradation of the Bull Canal, making its water unsuitable as a raw water supply. Analysis of the limited data currently available indicates that the water is useable as a raw water supply; i.e., suspended solid concentrations are high, no toxic parameters are present. However, projected concentrations of nitrates in the canal after discharge from the proposed facility will inhibit the development of these waters as a water supply, particularly for the Town of Frederick, and possibly could affect a raw water source for the Town of Ft. Lupton."
>
> "The State of Colorado defines raw waters suitable for potable water supplies as follows: (3)
>
> 10 'These are waters which, after receiving approved disinfection such as simple chlorination or its equivalent or which after receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent) will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto.'
>
> "Standard water treatment as defined above will not effectively remove nitrate."
>
> "Annexation requirements of Frederick, Colorado require that lands brought into the town must also provide additional water supplies. Landowners surrounding Frederick generally own shares in FRICO delivered by the Bull Canal. Therefore, implementation of a plan which discharges effluent to the Bull Canal would render these waters unacceptable as a water supply for Frederick. Filings have not been made to change the use

9. EPA believes that the no federal action alternative as presented in the EIS presents the realistic no action alternative. This is a consequence of previously negotiated legally binding agreements, (i.e., the Four Way Agreement), which would require re-negotiation between all parties prior to returning to what is indicated as a status quo option. Northglenn is in fact committed to the construction and operation of their proposed Water Resource Management Plan. EPA, therefore, does not believe that the no action alternative can be defined in terms of Northglenn receiving its future water supply from Thornton and future wastewater treatment at Denver Metro.

10. EPA concludes that since the Canal is not presently used for a domestic water supply, nor has there been any formal request to designate the Canal for domestic water supply, there is no need to protect the Canal for water supply.

> of Bull Canal waters to a water supply and the current Larimer-Weld 208 Clean Water Plan designates the Canal solely for agricultural use. Thus it is EPA's conclusion that the protection of these waters for a potential future water supply source is unnecessary and EPA recommends that Frederick explore other options to satisfy future water supply demands."

The position of the Town of Frederick in connection with these statements is as previously stated. If this project is constructed, the City of Northglenn will in effect be trading an existing acceptable supply for a future supply which will negate or substantially cripple the Town of Frederick's ability to provide an adequate water supply for its future residents. The justification for such a trade-off is certainly lacking.

11 7. Page 45. Under "SUMMARY OF WATER SUPPLY ALTERNATIVES CONSIDERED".

The City of Northglenn has not examined the alternative of staying with the City of Thornton. This alternative is likely the most viable of all and certainly should be a required consideration.

12 8. Page 89. Under "PUBLIC HEALTH - TAILWATER CONTROL AT FREDERICK AND FIRESTONE".

> "During irrigation periods, Bull Canal tailwater from lands adjacent to Frederick and Firestone flows through town streets. Northglenn has agreed with EPA to provide necessary facilities to control the tailwater so that it will not enter the Towns of Frederick or Firestone. The plan, which has been conceptually developed, will consist of three ponds that will receive the tailwater from collection ditches along the lower edges of the fields adjacent to the towns. Low dikes will reduce stormwater inflow into these ponds. Water from the ponds will be recirculated back to the irrigated land. (Should these fields be irrigated during rainfall, some diluted tailwater could flow into the streets.) According to the filings Northglenn has made with the Water Court, their position is that this water is from Standley Lake storage and impounding of this water will not create a water rights problem. EPA concludes that if the Water Court disagrees, this amount of water will have to be included in Northglenn's augmentation plan."
>
> "The proposed grant condition is: 'Northglenn will provide physical measures to prevent the flow of tailwater from adjacent agricultural land into the Towns of Frederick and Firestone or any other residential area. Consultation with Frederick and Firestone on the design and location of these facilities is necessary.'"

11. The alternative of Northglenn continuing to receive a water supply from the City of Thornton is examined in the alternative water supply section of Chapter 3.

12. Please refer to response to Item 4 above.

12 The Town of Frederick is greatly concerned about the ability of Northglenn to control the tailwaters. Even these statements as a concept indicate that "some diluted tailwater could flow into the streets." It is apparent that even Northglenn cannot assure a 100% resolution of this problem even in a conceptual form. If the concept is questionable, certainly the result will provide less than adequate protection.

Throughout the report, there are statements and references to the points addressed in this letter. In this regard, the Town of Frederick's position remains the same. We strongly urge that funding of this project by the EPA not be granted until such time as the concerns of the Town of Frederick have been properly resolved and not merely addressed.

Sincerely,

Holly Wm. Hall
Mayor

ADOLPH COORS COMPANY
GOLDEN, COLORADO

February 13, 1980

Environmental Protection Agency
Region VIII
Office of Public Awareness
1860 Lincoln Street
Denver, Colorado 80295

Re: Northglenn Water Management Program, City of Northglenn, Colorado, Draft Environmental Impact Statement

Dear Sirs:

The Adolph Coors Company as a substantial water user with vested water rights on Clear Creek has followed the Northglenn Water Management Program with a great deal of interest. More particularly, Coors is participating in the state water court adjudication process which was commenced by the City of Northglenn with its filing in the Water Court of its plan for augmentation. This filing and the judicial ratification of the plan, of course, are necessary prerequisites for the completion of any viable Northglenn Water Management Plan. Therefore, these comments will be primarily addressed to statements contained in the draft Environmental Impact Statement which have a direct bearing upon the various water adjudication proceedings which will ultimately affect all water users on Clear Creek and in particular the Adolph Coors Company.

1 As a preliminary matter, Coors states that the contemporaneous decision to prepare a Draft Environmental Impact Statement (DEIS) and the distribution of that document to the public afforded no meaningful public participation in the DEIS scoping process. This oversight should be remedied to afford proper public participation.

RESPONSE: 1. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

DETAILED COMMENTS

Chapter 1

2 On page 5 the DEIS describes the fact that there are only four options identified by Northglenn and EPA within the framework of the plan. If in fact this scoping of alternatives to the proposed action was arrived at jointly by Northglenn and EPA without public participation and input, then this breach of procedure should be corrected and total participation should be required prior to the scoping of alternatives. The evaluation of other alternatives which do not require the "borrowing" of water from either the South Platte River or the FRICO system should be carefully evaluated.

3 Under the section entitled Protection of Vested Rights, the statement is made that this plan can be administered by the State Engineer. This statement should be substantiated far beyond a mere reference to a conclusion based upon "expert opinion." It is also significant that EPA has made no conclusion with regard to whether or not some water users may suffer adverse impacts from the implementation of the plan. If EPA is to make this conclusion in the final statement, a substantial amount of documentation would be necessary.

Chapter 2

4 On page 16 the statement is made that "By obtaining water from FRICO, Northglenn has assured itself of water of adequate quality and a certain water supply source for the future." This very general statement should be substantiated by specific references to sources and amounts.

5 The next paragraph states that "The environmental consequences of [failure to implement the current plan] cannot be fully determined and may be of lesser or greater magnitude than those resulting from the full implementation of Northglenn's current resource plan." This type of general statement raises many more questions than it answers. EPA's primary goal must be to specifically identify those options which would have a lesser environmental impact.

2. EPA has included an analysis of other water supply alternatives. See Chapter 4.

3. EPA believes that the Northglenn Water Resource Management Plan can in fact be administered but does have inherent difficulties which must be overcome prior to full implementation.

4. EPA believes that the sources and amounts of Northglenn's future water supply under the FRICO exchange are discussed in detail in the Environmental Impact Statement. Reference should be made to the chapters on Alternatives and Environmental Issues.

5. The comment made is taken out of context. The environmental consequences relate specifically to Northglenn being forced to secure other sources of irrigation water, nontributary groundwater, tributary groundwater or any combination thereof and is not a result of the failure to implement the current plan.

Chapter 3

6 In discussing the significant environmental impacts which affect water resources in the section entitled Tributary Ground Water, a statement is made that the tributary well field is not expected to have a "noticeable impact on agriculture." It should be emphasized that this of course is not the criteria in water court. Rather, a junior water right may only be put into use if the use does not adversely affect a senior right. Since the impact of the proposed well field cannot be determined at this time, its existence can also not be relied upon.

7a The section which deals with the Standley Lake Yield is replete with erroneous assumptions about Colorado water law. Assumption No. 2 that would provide credit for accretions to the Big Dry Creek system due to increase in urban runoffs does not take into account the fact that those runoffs belong to the river and cannot be appropriated by the users of Big Dry Creek. The third assumption concerning the increased yield of the FRICO shares assumes that the change in use of the FRICO shares from agricultural to industrial and municipal use and the associated increased consumptive efficiency does not increase the burden on the stream system. In fact, this type of change in use results in an expanded use and an enlarged burden on the system. 7b Finally, the assertion that better prediction of dry year yields based upon snow pack estimates which are improved, has no associated quantifiable benefit. Any attempt to quantify this improvement, can be nothing more than mere speculation.

8 In the section entitled Bull Canal Water Distribution, there are certain statements concerning the intentions of Northglenn with respect to equalizing the distribution of water among the farmer shares upstream of payback return and the farmer shares downstream of payback return. Although these intentions may be admirable, intentions alone do not meet the burdens required for an augmentation plan to show lack of injury to any vested water rights.

9 The statement concerning EPA's conclusions about the yield of augmenting rights for purposes of the augmentation plan without the necessary technical backup data is gratuitous and should be removed from the document.

6. EPA policy to protect agricultural production lands has no relation to the private transfer of water rights as administered by the Water Court.

7a. EPA believes that these issues will be resolved in the Water Court.

7b. Please refer to the agricultural analysis which has been revised and presented in the Environmental Impact Statement.

8. EPA believes that this issue will have to be resolved between Northglenn, FRICO and the courts and therefore will make no response at this time.

9. Engineering data were provided by Northglenn which substantiate this conclusion and were utilized in the development of the assessment of yields.

10 The statement on page 30 concerning the susceptibility of this plan should it be implemented to administration should coincide with those statements referenced earlier wherein the EPA concluded that the plan was capable of administration.

11 In the section entitled Ditch Protection, it should be emphasized that the particular yield of the shares of the mutual ditch company may be diminished if there is a requirement as part of the implementation of the plan to insure that the water to be used by Northglenn is available in the ditch as a carrier medium. If this is the case, then there may be times and conditions when the shares belonging to Northglenn may not be available for the specific domestic uses envisioned by the plan.

12 Coors agrees with EPA's conclusion that the transfer of South Platte return flows to the Northglenn/FRICO system represents a depletion to the South Platte and therefore requires additional sources of augmentation water.

13 The DEIS summary of legal issues found on page 32 is, of course, not an exhaustive listing of the legal issues involved with such a complex augmentation plan. However, Coors agrees with the conclusion made by EPA that in all probability additional augmentation water will be required prior to approval of the plan since, at the very least, the plan involves such highly controversial legal issues as successive use, expanded use, change in use, and the capture of waters native to the stream out of priority.

14 In addition to those legal issues highlighted above, in the succeeding sections of Chapter 3 wherein there are discussions about the agricultural productivity components of the plan, it should be noted that even if the net agricultural productivity is enhanced, this is not the criteria for assessing damage in a water court proceeding.

15 Rather, if the lands that are taken out of production supplied a source of recharge and a component of a conduit system for ground waters tributary to the Platte, then the elimination of irrigated agricultural use from those lands will have caused an interference in the historic pattern of water usage in that portion of the Platte system, and that interference with vested rights must be compensated for.

10. See response to Item 3, above.

11. EPA acknowledges this feature of the plan. EPA further recognizes that this will have to be resolved through implementation of the project and will involve the resolution of these problems with the participation of FRICO and Northglenn.

12. EPA acknowledges.

13. While EPA recognizes the probability that additional augmentation water will be required prior to water court approval of the plan, this should not be construed as a legal determination of this need. It is EPA's position that the entire augmentation plan is subject to water court approval and that process will resolve this issue.

14. See response to Item 6 above.

15. EPA is not in a position to comment on this as this is subject to Water Court determination.

Chapter 4

16 As an overall comment concerning the approach taken to the selection of alternatives, it becomes evident from the scope of alternatives discussed within the confines of the DEIS that no real alternatives to the plan were considered. Rather, only alternative means of implementing the one plan for water supply for Northglenn were considered. This type of analysis does not in reality provide a true examination of alternative means of supplying Northglenn with the water it seeks to supply its potential customers.

17 On page 56 the statement is made that the increased nitrogen concentrations are not expected to cause problems in either sugar beet or barley production. This assumption cannot be substantiated. If in order to be marketable the sugar beet crops to be irrigated by water from Northglenn's effluent must have no nitrogen applied after July 15 of each year, then this means that the Northglenn effluent cannot be applied after July 15th by those FRICO stockholders who are irrigating sugar beet crops. This of course means that either Northglenn must supply them with an alternate supply of water or there will be a total interruption of the historic irrigation pattern of acreage planted in sugar beets.

18 The potential adverse impacts of the plan set forth on page 82 with respect to the recharge of the ground water alluvium are adverse impacts of the plans commented upon previously herein, and are issues which must be resolved prior to the approval of the augmentation plan in water court.

Chapter 5

19 Although the thrust of EPA's mitigation measures is to safeguard its investment of public funds, which is admirable, it should refrain from requiring mitigation measures that might be contrary to law. In particular, there should be no requirement to recirculate or prevent the natural return of irrigation waters from the FRICO system to the South Platte as set forth by the proposed grant condition quoted on page 89. This requirement may have the effect of mandating

16. Please refer to the revised alternative section presented in the final Environmental Impact Statement. EPA believes that this chapter presents a full range of alternatives available to Northglenn for water supply and wastewater treatment.

17. EPA believes that its assessment and conclusions regarding nitrogen impacts on crops is comprehensive and valid. EPA refers to the support of the proposal in this regard by the Great Western Sugar Company in their testimony at the February 13, 1980, public hearing.

18. Acknowledge.

19. While EPA offers an opinion on this matter it is not to be construed as legal in nature, as this issue is subject to a determination by the Water Court. EPA believes that a possible alternative would be more augmentation water provided by Northglenn to mitigate any lack of augmentation that may be identified with the plan.

19 an interference with other vested water rights by requiring successive use and expanded use of waters which historically were returned to the South Platte River and which provided flows for other water users on the Platte. All of the proposed grant conditions must be evaluated against the requirements of Colorado law.

Chapter 6

20 Once again, with reference to our earlier comments, it appears from the list of public participation meetings listed in Chapter 6 that there has been no attempt prior to issuance of the DEIS to involve the public in the process of scoping the alternatives to be considered in the DEIS.

Appendix

Coors will not specifically discuss any of the conclusions made in Appendix A concerning Colorado water law. Any discussion of the legal impacts of this plan are rightfully reserved for the water courts of the State of Colorado.

Thank you for your attention to these matters.

Sincerely,

Lyle E. Bush

LEB:jh

20. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

Phone: 833-3281

TOWN OF FIRESTONE
WELD COUNTY
FIRESTONE, COLORADO 80520

February 13, 1980

TO: Envioronmental Protection Agency

RE: Proposed Northglenn Sanitation Facility
Public Hearing

The Town Board of the Town of Firestone wishes to be placed on the public record as being opposed to the above for the following reasons:

1 1. No case, we feel, has been definitely made to rule out the alternatives to the above facility. As the present supplier of potable water and the present sewerage processor have stated that they can adequately meet the needs of the City of Northglenn into the future, the need for the facility and the reuse of irrigation water has not been adequately proven.

2 2. Our community, together with the Town of Frederick, will be faced with the prospect of sewerage in the form of irrigation runoff coursing through the streets of our towns. Certain "conceptual" solutions, we are told, will offer adequate protection form this source of pollution. At no time have any officials of our community been involved in the determination of what these "conceptual" solutions are to be nor the adequacy of the proposals. Data which I requested in mid-December which I was told by the City of Northglenn was available, pertaining to studies of hazards of a water re-use system have yet to be received. In addition, the proposed holding pond solution would need to be extended to protect all of section 19 to the north

RESPONSE:

1. EPA has revised its alternative analysis on the proposed system. Please refer to Chapter 3 of the final Environmental Impact Statement for a discussion of the alternatives considered.

2. EPA believes that the tailwater control plan proposed by Northglenn will provide adequate controls of the tailwater within the communities of Frederick and Firestone. The conceptual solutions are presented in greater detail in the final Environmental Impact Statement under mitigation measures. In reference to section 19 being impacted by tailwater, EPA has determined that this will not occur as a consequence of the hydrologic basin drainage characteristics and that the proposed tailwater control plan will intercept any water prior to entering section 19.

Phone 833-3291

TOWN OF FIRESTONE
WELD COUNTY
FIRESTONE, COLORADO 80520

EPA - page 2

2 of the Town of Firestone. His parcel is presently under development into single family dwellings. We do not feel that the three detention ponds "conceptually" proposed for Firestone and Frederick are inadequate for this purpose.

3 3. The polluting (nitrates) of the Bull Canal system, which is presently a safe source of drinking water, in our opinion runs counter to the mandate set by Congress for the Enviornmental Protection Agency. Pollution of this nature will not clean up our Nation's streams and waterways. Also, degredation of water in this manner is contrary to the laws of the State of Colorado and the Larimer-Weld COG 208 Water Quality Plan.

In light of these objection, we staunchly oppose the construction of the Northglenn facility.

Sincerely,

Allan J. Becker
Mayor

cc: William Armstrong
Gary Hart
Timothy Wirth
Holly Wm. Hall
Clifton T. Elliott

3. EPA concludes that since the Canal is not presently used for a domestic water supply, nor has there been any formal request to designate the Canal for domestic water supply, there is no need to protect the Canal for water supply.

Phil notes

COMMENTS OF THE GREAT WESTERN SUGAR COMPANY
ON THE
NORTHGLENN WATER MANAGEMENT PROGRAM
February 13, 1930

The company has given careful review of the proposed Draft Environmental Impact Statement and has met with representatives of the City of Northglenn and their engineering consultants.

1 There are two factors to be considered in the proposed program. The first is the nitrogen present in the discharge wastewater that will find its way ultimately to sugar beet fields as irrigation water. An excess of nitrogen applied to sugar beets late in the growing season (August through September) could seriously affect the growth and sugar yield. The range of seven to nine pounds nitrogen per acre presents no problem to the beet grower, provided the grower knows in advance that this will indeed be what he can expect early enough in the growing season so that he can reduce his ~~early~~ TOTAL nitrogen application to allow for the nitrogen coming late in the irrigation water. It is our understanding that Northglenn intends to make this information available to the irrigation water users on a timely basis. As long as this information does get out to the water users, Great Western sees no problem with the projected amounts of nitrogen in the wastewater being used for irrigation.

2 The second point of concern is the possibility of algae bloom in the holding ponds. It is our understanding that the system is designed to preclude algae blooming and as long as this holds true, we have no problem. Our worry is in what chemical treatment would be resorted to, should an algae problem develop. The addition of copper is the usual treatment since it is both efficient and inexpensive. Copper is quite toxic to sugar beets. Our point in this comment is not to borrow trouble, but only to be sure that the operators of the management plan are aware of the potential hazards to beet growers, should the algae prove to be a problem.

RESPONSE:

1. EPA would like to acknowledge Great Western Sugar Company's clarification of the nitrogen issue relative to their operational needs. As part of the agricultural reuse manual, Northglenn will be providing information on nitrogen content to the farmers using wastewater effluent in a timely manner so that appropriate fertilizing requirements can be determined.

2. Northglenn has considered the option of using copper sulfate as a potential mitigation measure for algal blooms in the storage reservoir. However, because of the potential problems of copper related to sugar beets and other crops, EPA does not find this to be the most acceptable alternative and has requested Northglenn to consider other options for algal bloom mitigation should such an event occur.

3 Great Western wishes to express its appreciation for the opportunity to comment at this stage in the planning process. We do not wish to create the impression that we have doubts about the assurances we have already received relating to nitrogen content of the wastewater discharge or the need for algae control. We merely want to be on record of making known our potential problems, should the unforseen become a reality in the future.

3. Acknowledge.

COMMENTS ON HEARING ON
NORTHGLENN WATER MANAGEMENT PROGRAM ON
FEBRUARY 13, 1980

By Fu Hua Chen, President
Chen and Associates, Inc.
Geotechnical Engineers

1 I have listened for four hours on the impact of using the treated sewer for irrigation purpose. The impression of the hearing so far appears that the design team has not given any consideration to the various impacts which affect the environmental and ecological effect of this project. I can assure you that our team, which consists of highly technical and competent consultants, has investigated the geological, geotechnical, hydrological as well as the sanitary aspect of the project. There is no phase of the problems that may exist in this project that has not been studied thoroughly by our team. The hydrological study alone, including the water right problem, the water transfer problem, the return flow problem, is in such a large volume that if I would read the entire contents, it would keep the audience in this hearing for probably ten hours. I can assure our opponents that we can match, acre by acre, foot by foot, what the brilliant young engineer has claimed, and I challenge all opponents to all figures we have presented. The mere fact that our design has survived the crucial examination from EPA suffices to tell that we have done our homework.

I am not a chemist nor a biologist, and I do not know the scientific impact of using the treated sewer for irrigation water, but I do know that the Chinese have been using raw sewage as fertilizer for thousands of years. It appears that the sewage has no ill effect on plant growth. On the contrary, the farm product appears to be much superior to chemically fertilized vegetation. I do believe this new process marks a drastic change in thinking on sewage treatment as well as farming practice. As previously testified, this project not only has great impact on the State of Colorado but also the Nation. I do think it is about time that we totally re-evaluate our past procedure of sewage treatment and irrigation process and look ahead for a new way of sanitary engineering in which we can improve both the environmental and the ecological impact of our system.

RESPONSE: 1. Acknowledge

Town of Dacono

512 Cherry Street
P.O. Box 186
Dacono, CO. 80514
Metro- 825-1256
Local- 833-2317

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February 18, 1980

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Water Division

U.S. Environmental Protection Agency
Regional Administrator, Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

This letter is in response to the draft Environmental Impact Statement concerning the proposed Northglenn wastewater treatment facility prepared by your organization.

There are several issues in this study with which the Town takes exception. Several of these issues have been addressed by Mayor Hall of Frederick in his letter of February 12, 1980. The Town of Dacono has adopted this letter by resolution.

1 One of the issues responded to by Mayor Hall concerned the position of the EPA concerning potential domestic use of the Bull Canal which presently serves the irrigation needs of southern Weld County agriculture. The position of the EPA is that protection of these waters is not necessary due to their current use. One problem with this position is that the Bull Canal system flows through an area that has exhibited a great potential for urbanization. Dacono alone has increased its population eight fold in the last ten years. This growth trend is continuing. Municipal condemnation suits caused the initial plans for Northglenn's "alternate technology". What the Northglenn plan will create is a rash of other municipal condemnation suits as the water needs of southern Weld County municipalities grow. In essence, municipal condemnation actions will be transferred from Northglenn to southern Weld County.

RESPONSE:

1. There is a recognized administrative procedure for the classification of state water. Such procedures could result in the reclassification of the Bull Canal as a water supply source. Currently, the state has not received any request for reclassifying the Bull Canal as a water supply source.

The disappointing element in the EPA decision concerning the Bull Canal is in a lack of planning. One could justifiably say that water planning for local governments is not an EPA function, and we agree. However, the potential for urbanization in southern Weld County and therefore a need for the Bull Canal system as a domestic water source, was not even considered. Your position on the Bull Canal is analogous to stating that because there are currently Snail Darters alive, these fish do not require protection.

2 Another key element of the draft EIS concerning Dacono is the requirement by Northglenn to either disinfect the future irrigation water in the Bull Canal or provide an alternate source of such water. It is unclear

2. EPA's requirement that Northglenn disinfect or replace Dacono's nonpotable water was in the interest of maintaining water of an acceptable quality for nonpotable use. If EPA's proposed solution is unacceptable to Dacono, then Northglenn must negotiate a mutually acceptable solution to solve the identified public health problem. EPA is unaware of any detrimental effects of chlorine on lawns and gardens.

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2 whether the City of Northglenn is bound to accept the alternative which is acceptable to Dacono. Disinfection through chlorination is wholly unacceptable to the Town of Dacono. It is interesting to note that in the draft EIS a considerable amount of attention was paid to the effects of various chemicals on farmland. No attention was paid to the potential effects of chlorination on Dacono's lawns and vegetable gardens. It would appear that as municipal opposition to the Northglenn project grew, this option was considered as a convenient way to buy off that opposition without considering its negative environmental impacts.

3 It is also interesting to note that in Table 3-1 of the draft EIS (page 20) you list comparisons of various levels of contaminants projected to be in the Bull Canal after completion of the Northglenn facility. Unfortunately, the source of this information is the company which will profit from the facility's construction! What the Town of Dacono was looking for in the draft EIS was an objective assessment of the environmental impacts of the proposed facility. What was presented was a rationale for funding the City of Northglenn's project by ignoring or "soft-peddling" opposition arguments.

On page 33 of the draft EIS, you state "...the exchange plan will sufficiently protect FRICO shareholders." I would like to point out that the Town of Dacono is also a FRICO shareholder, and doesn't feel sufficiently protected by your Agency.

Sincerely,

Clifton T. Elliott, Sr.
Mayor

3. EPA did perform an independent analysis of the entire project proposed by Northglenn. This analysis was done with the assistance of Engineering-Science, consultants not otherwise associated with the project.

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
L. Scott Tucker, Executive Director
TELEPHONE 455-6277 · SUITE 156 B · 2480 W. 26TH AVENUE · DENVER, COLORADO 80211

Executive Committee:
Wally Toevs
Boulder County
Cathy Reynolds
City of Denver
Kenneth M. Gorrell
City of Arvada
Kenneth M. MacIntosh
City of Denver
John J. Nicholl
Arapahoe County

Members:
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Jefferson County
Bob Briggs
Adams County
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City of Boulder
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Engineer
W.G. Duncan
Douglas County
William H. McNichols
City of Denver
Sally Parsons
City of Littleton
Arlen E. Patton
Engineer
Anthony E. Richer
City of Thornton
M.L. "Sam" Sandos
City of Denver

24148

February 15, 1980

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RECEIVED
FEB 20 1980
U.S. EPA REGION VIII
Water Division

Mr. Roger L. Williams
Regional Administrator
U.S. Environmental Protection Agency
1860 Lincoln Street
Denver, CO 80295

Subject: Comments on Draft Environmental Impact Statement,
Northglenn Water Management Program

Dear Mr. Williams:

I attended a public hearing in Northglenn on February 13, 1980 regarding the recently completed draft Environmental Impact Statement for the Northglenn Water Management Program. I was not able to stay for the entire public hearing, and therefore did not make a verbal statement. I understand, however, that EPA will receive written comments regarding the Environmental Impact Statement until February 25, 1980. Please consider this the comment of the Urban Drainage and Flood Control District regarding the draft Environmental Impact Statement.

1

RESPONSE: 1. Acknowledge

The interest of the Urban Drainage and Flood Control District is centered on Northglenn's efforts to address urban runoff controls. It is stated on page 100 of the draft statement that "...EPA determined that prior to granting funds for construction or expansion of wastewater facilities, the general purpose governments within the proposed service area must show progress in the form of ordinances adopted or recent efforts taken towards implementing the non-point source controls recommended by the Clean Water Plan." This determination was made by EPA in response to a DRCOG recommendation in the recently completed Clean Water Plan for the Denver Metropolitan Region.

From a regional and national point of view, there is a great deal of confusion as to how to address the stormwater pollution problem. There is general agreement that stormwater contains pollutants, but the source or extent of the pollutants is not well understood. Also, there is little understanding as to the effects of stormwater on receiving waters, as well as what the beneficial effect would be on receiving waters if urban runoff was in some way treated. Congress has, in fact, taken the position that the urban stormwater pollution problem is not well enough understood for the Federal Government to commit funds for the abatement of the problem. The Federal approach is to require local governments to address the problem through the concept of best management practices.

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cy: RA, DRA,
MO

It seems that irrespective of the lack of understanding regarding the urban stormwater pollution problem, the City of Northglenn is going to utilize stormwater in a total water management program. This is one of the few efforts that I know of in the nation where urban runoff is being used as a part of a total water system. All other factors being equal, Northglenn should be encouraged and supported in the pursuit of the concept of utilizing urban storm runoff in a total urban water management context.

The draft Environmental Impact Statement recognizes Northglenn's urban runoff controls as a positive environmental feature, and I would like to reinforce that conclusion.

Sincerely,

Scott Tucker

L. Scott Tucker
Executive Director

LST/lf

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Rocky Mountain Region
11177 West Eighth Avenue, Box 25127
Lakewood, Colorado 80225

1950
February 20, 1980

Roger L. Williams, Regional Administrator
U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

Thank you for the opportunity to review the Draft Environmental Impact Statement for the Northglenn Water Management Program, City of Northglenn, Colorado.

We share the concern about odor emission discussed in Chapter 4 (page 67), and air quality described in Chapter 5 (page 101), of the Statement. A significant positive contribution toward reducing potential odor emissions and improving air quality can be made in the project area.

1 A program of planting trees, shrubs and other vegetation, can be a step in creating a natural-like situation that will help compensate for some of the adverse odor and air pollution impacts. The plantings can improve the long term aesthetic quality of the project area.

The city of Northglenn has a forestry staff that can recommend planting stock and develop a schedule for a planting plan. This could all dovetail into the project schedule.

I recommend consideration of my comments in your final Environmental Impact Statement.

Sincerely,

Craig W Rupp
CRAIG W. RUPP
Regional Forester

FEB 27 1980

RESPONSE:

1. Northglenn will provide a landscaping plan that will provide for the planting of grasses, trees and shrubs.

DEPARTMENT OF THE ARMY
OMAHA DISTRICT CORPS OF ENGINEERS
6014 U.S. POST OFFICE AND COURTHOUSE
OMAHA NEBRASKA 68102

REPLY TO
ATTENTION OF

MROPD-A 24177 20 February 1980

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RECEIVED
FEB 25 1980
EPA REG[illegible] VIII
Water Division

Mr. Roger L. Williams, Regional Administrator
Region VIII - U.S. Environmental Protection
  Agency
1860 Lincoln Street
Denver, CO 80295

Dear Mr. Williams:

We have reviewed your Draft Environmental Impact Statement (DEIS) for the Northglenn Water Management Program, Northglenn, Colorado pursuant to Section 404 of the Clean Water Act and have the following comments.

1 Any filling in waterways, lakes and wetlands in conjunction with the project must be authorized by either a nationwide permit or by an individual permit. The DEIS states that the final plan has not been adopted. In order to determine the permit, if any, to be issued it is important that the final plan be submitted to this office for review in accordance with Section 404.

In the event an individual permit is required, the following regulations must be adhered to.

a. An evaluation report prepared in accordance with the Section 404(b) guidelines promulgated by the Environmental Protection Agency and appearing in the Federal Register of 18 September 1979.

b. The Endangered Species Act, as amended.

c. The Fish and Wildlife Coordination Act.

d. The National Historic Preservation Act (Section 106).

We would recommend a review by the Advisory Council on Historic Preservation. We would advise you that the Final Environmental Statement should contain a statement that the project will not conflict with the intent of Executive Order 11988 (Floodplain Management) as regards to the South Platte River.

Orig: BW
cy: RA, DRA, MO, RC

RESPONSE:

1. Northglenn has obtained a nationwide permit for the construction of its urban stormwater runoff retention basin and interceptor crossing of Grange Hall Creek. Northglenn must comply with all provisions of the 404(b) guidelines. No known impacts on endangered species have been identified. Issues concerning the Fish and Wildlife Coordination Act and the National Historic Preservation Act are responded to by the appropriate agency comments (Fish and Wildlife Service and Colorado Historical Society).

The City of Northglenn operates under the complete floodplain management ordinances as developed by the Federal Emergency Management Agency with respect to Grange Hall Creek. No impact on the South Platte River floodplain is expected.

MROPD-A
Mr. Roger L. Williams

20 February 1980

2 We will anticipate receiving more finalized data from you, and at that time we can be more specific in our comments.

If you have any questions please contact this office.

Sincerely,

JOHN E. VELEHRADSKY
Chief, Planning Division

---

2. Final plans and specifications will be forwarded to your office upon completion.

W. W. WHEELER AND ASSOCIATES, INC.
CONSULTING ENGINEERS
SUITE 301
770 WEST HAMPDEN AVENUE
ENGLEWOOD, COLORADO 80110

PHONE
761-4131

February 20, 1980

Mr. Roger Williams
Regional Administrator
United States Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80203

Re: #815

Dear Mr. Williams:

On behalf of Consolidated Ditches Company, enclosed are our com[illegible]s concerning the Northglenn Water Management Program draft environmental impact statement prepared by the Environmental Protection Agency in January, 1980. It is intended that our report be considered a part of the public review and comment process.

Very truly yours,

W. W. WHEELER AND ASSOCIATES, INC.

Raymond A. Hogan /by scT

Raymond A. Hogan, P.E.

RAH:sck
Encl.

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INTRODUCTION

On January 11, 1980, EPA published a "Draft Environmental Impact Statement" for the Northglenn Water Management Program. In behalf of the Consolidated Ditches, W. W. Wheeler and Associates, Inc. reviewed this Draft Environmental Impact Statement. During this review process, Mr. Weston W. Wilson (EPA Project Officer), Mr. Paul N. Seeley (Engineering Science), Mr. Allan L. Udin (Engineering Science) and Mr. Harold F. Bishop (Tipton and Kalmback) were contacted. All of these preparers of the report were very cooperative and helpful in providing foundation materials used in the draft EIS and in answering questions concerning the draft EIS. Mr. Paul Seeley advised us that the assumption concerning South Platte current consumptive use on page 39 should be changed from 2.7 to 1.0 acre-feet per acre.

The scope of our review and the comments contained herein was limited to the subjects of agricultural productivity, water quantity and water management plan alternatives. Based on the available information, we have estimated the impacts of Northglenn's water management plan on vested water rights along the South Platte and its tributaries. In order to comment on the agricultural productivity analysis, we have gathered information concerning agricultural productivity from government agencies, private agencies, farmers along the South Platte, and farmers under the FRICO Bull Canal system. Our comments relative to alternative plans are based upon our general knowledge of available water supplies and our contacts with Thornton representatives and Denver Water Board representatives.

The Consolidated Ditches have requested Northglenn to produce engineering studies among other items relating to the Northglenn water management plan. On February 11, 1980 we were advised that Northglenn would not provide the requested engineering studies until the studies had been finalized. Apparently the foundation materials supplied by Northglenn's engineers are only preliminary and the results and conclusions of the draft EIS are based, at least in part, on preliminary engineering studies and a water management plan that has not been completed or finalized. For example, it was noted (Page 27) that "...final evaluation of the impacts of the well field cannot be completed until the field is located and the wells are designed." Any changes in the preliminary engineering studies or changes in the water management plan could significantly change the results and conclusions contained in the draft EIS.

In the draft EIS, several legal issues were identified (Pages 32 and 33). Whether or not these legal issues will be resolved in favor of Northglenn is a subject to be addressed by attorneys and decided by the Water Court. In the draft EIS, the authors have expressed their opinion that changes in Northglenn's water supply plan by the Water Court are likely and the probable effect of such changes will be to require more water for augmentation (Page 33). In our opinion, environmental impacts of Northglenn's water management plan can and should be determined separately from any speculation or assumptions regarding resolution of the legal issues. Resolution of the legal issues in favor of either Northglenn or the opponents will not change the environmental impacts of what Northglenn plans to do. Since most of the flow of the South Platte River system is presently being used, reductions in the flow caused by Northglenn's water management plan will result in an adverse impact to other water users. This total impact should be addressed in the EIS regardless of whether Northglenn will be required by the Water Court to mitigate the impact through acquisitions of additional augmentation water.

IDENTIFICATION OF IMPACTS

Northglenn's water management plan will impact the environment in several different ways. The impacts that are identified below relate only to the subjects of agricultural productivity, water quantity, and water management plan alternatives.

1 Bull Canal Lining - Lining of the Bull Canal is an integral part of the Northglenn water management plan. As part of the Four-Way Agreement, the Bull Canal is to be lined to eliminate or at least significantly reduce seepage. In turn for lining the Bull Canal, FRICO has agreed not to charge Northglenn for any transportation loss downstream from Standley Lake. We concur with the authors of the draft EIS that lining the Bull Canal could adversely impact downstream water users who have historically depended on seepage water from the Bull Canal (Page 33). The draft EIS, however, does not identify the magnitude of this impact or consider this adverse impact to any further extent.

The adverse impact on other water users can be estimated for dry and average years based on information available (Figure 3-2). In an average year, 16,611 acre-feet would be released from Standley Lake. Historically, because of high seepage loss (Page 27), only 60 percent of this water actually reaches the farm headgate. The remaining 40 percent (6,640 acre-feet) seeped from the Bull Canal and returned to the South Platte stream system. As used herein, the South Platte stream system refers to the surface and alluvial groundwater associated with the main stem of the South Platte and its tributaries. If this seepage is reduced to 10 percent by lining the Bull Canal (Page 27), the reduction in seepage would amount to 4,980 acre-feet. Since this salvaged water would be used for irrigating lands under the Bull Canal, we estimate that 65 percent would be consumed and 35 percent would

RESPONSE:

1. Lining the Bull Canal is not an integral part of the Northglenn water management plan. The Bull Canal lining benefits the farmers served by the canal system and will increase the water yield to them over what they would receive from an unlined system. Indirectly, the cities served by FRICO, including Northglenn, also benefit as lining is part of the Four Way Agreement. There may not have been such agreement without this provision.

At the time of preparation of the draft agreement only 1450 shares of the total 2373 shares in the FRICO system were in predominantly agricultural ownership. The balance of 923 shares belongs to Northglenn (214.8 shares) and Thornton and Westminster (703.52 shares). The average year release to the agricultural users will be 10,150 a.f. In a dry year the release is 7250 a.f. The amount of water saved by lining is approximately 3045 a.f. in an average year and 2175 a.f. in a dry year.

The lining of a canal is generally considered a water conservation measure. With a fixed given release from Standley Lake the yield to the farmer will be greater with the lined canal system than with an unlined canal system. With more water available there will likely be more consumptive use with the lining than without it.

return to the South Platte stream system. The net adverse impact to the stream system would be 3,240 acre-feet for an average year.

1 In a dry year, 11,865 acre-feet would be released from Standley Lake. Using an analysis similar to that explained above for an average year, the net adverse impact would be 2,310 acre-feet in a dry year. If the lining of the Bull Canal eliminates all of the seepage, the adverse impacts would be 4,320 acre-feet for an average year and 3,080 acre-feet for a dry year. The wet year adverse impact would be even greater than the quantities expressed above for an average year.

2 Northglenn Consumptive Use - According to Table 3-4, 4,140 acre-feet is the amount of water required for household and commercial use. For irrigation, 3,200 acre-feet is required in a dry year and 2,700 acre-feet is required in an average year. By assuming that three percent of the household and commercial water is consumed and that 75 percent of the irrigation water is consumed, the total consumptive use of Northglenn, exclusive of any reuse, is 2,520 acre-feet for a dry year and 2,150 acre-feet for an average year. These consumptive use quantities represent the water that is totally removed from the South Platte stream system, constituting an adverse impact.

3 Reuse of Sewage Effluent - By exercising the proposed FRICO exchange, Northglenn's sewage effluent would be stored and delivered for irrigation of lands under the Bull Canal. The additional consumptive use or adverse impact resulting from the exchange amounts to 700 acre-feet in a dry year and 560 acre-feet in an average year. These quantities were determined by adding the reservoir evaporation from Table 3-4 to an estimated 65 percent of the FRICO bonus. This 65 percent accounts for the percentage of the farm headgate delivery that is consumed.

By adding the adverse impacts caused by lining the Bull Canal, by Northglenn's consumptive use, and by reuse of sewage effluent, the total adverse impact amounts to 5,950 acre-feet in an average year and 5,530 acre-feet in a dry year. These quantities represent the total adverse impact of Northglenn's water management plan prior to any attempts to mitigate the adverse impacts.

2. The City of Northglenn currently has a water supply provided by Thornton which diverts water from the South Platte River system. Water use by Northglenn will continue whether or not the Northglenn exchange plan is implemented.

3. Northglenn proposes to return sewage effluent for agricultural use in return for the water borrowed from FRICO. This return includes a 10% or 500 acre-foot bonus plus evaporation from the Bull Canal Reservoir which will be used to store the return flow until it is delivered. The source of supply of water for the bonus and evaporation will be Northglenn owned-water either from its share ownership in FRICO, return flow from pumping nontributary wells, water diverted under share ownership in South Platte or Clear Creek ditches, or augmented out of priority diversions.

The combined effect of lining the Bull Canal, continued agricultural use of 1450 shares of FRICO, consumptive use by the City of Northglenn and evaporation and bonus create a net increase in consumptive use. The extent of injury to other water users, if any, is a matter that will be decided in the Water Court.

4 Alternative Impact Analysis - Although lining of the Bull Canal was an integral part of the Four-Way Agreement and in itself causes a very significant adverse impact, the question arises concerning what decree Northglenn is responsible for adverse impacts in part caused by other participants in the Four-Way Agreement. For this reason we performed an alternative impact analysis to determine the impact of Northglenn's water management plan excluding the Four-Way Agreement. In an average year Northglenn requires 6,840 acre-feet of water. Of the 4,140 acre-feet used for household and commercial use, we have estimated that three percent would be consumed directly and 65 percent of the remainder (sewage effluent) plus five percent for evaporation would be totally consumed in the land application process. This amounts to 2,935 acre-feet. Adding this quantity to 75 percent of the irrigation water that is consumed gives a total adverse impact on the South Platte stream system of 4,960 acre-feet for an average year. For a dry year, using a similar analysis, the adverse impact amounts to 5,335 acre-feet.

By comparing these quantities with the quantities derived in the first analysis, Northglenn is responsible for 83 percent of the adverse impact in an average year and 96 percent of the adverse impact in a dry year. By adding the adverse impact caused by the bonus arrangement that Northglenn made solely with FRICO, Northglenn for all practical purposes, is responsible for the entire adverse impact ranging from 5,500 to 6,000 acre-feet per year.

For comparison purposes, the adverse impact without the Four-Way Agreement but with sewage return at Metro would range from 2,100 to 2,500 acre-feet per year. In other words, in terms of water quantity the adverse impact would only be about 40 percent of the impact caused by Northglenn's proposed water management plan.

5 Impact of Providing More Augmentation Water - In the draft EIS, the comment is made in several places (Pages 9, 32, and 33) that Northglenn probably will need more augmentation water. However, the impacts of providing more augmentation water to mitigate adverse impacts on

4. The cities, along with the farmers, benefit from the provision for lining the Bull Canal. Lining, as mentioned previously, is a water conservation measure and will increase the yield to all shareholders. It is speculative whether or not the entire benefit could be attributed to Northglenn as the canal would probably be lined without the Northglenn exchange plan.

5. Providing additional augmentation water, if required, due to the possibility of inadequate water available in the plan may affect other water rights. In EPA's opinion, the quantity of water is less than the quantity referred to in the W. W. Wheeler report. It is acknowledged, however, that requiring additional augmentation water is likely to affect agriculture.

5 other water users were not considered. Mitigation of the identified adverse impacts ranging from 5,500 to 6,000 acre-feet per year, will require the dry-up of additional agricultural land unless some other alternative is selected. Drying up additional agricultural land, in turn, will adversely impact agricultural productivity.

6 Impact of Inadequate Replacement - The analyses in the draft EIS are based on annual quantities. In order to protect vested water rights, it is necessary to augment the South Platte on a timely basis. For example, if there is an adverse impact during August, augmenting the river in June will not mitigate the adverse impact. On page 9 it is concluded that "...the water rights to be used for augmentation are sufficiently senior for that purpose..." In order to reach such a conclusion, it would be necessary to perform an analysis on a daily basis. We suspect that augmenting water rights such as the Burlington, with a priority date of 10-20-1885, are not sufficiently senior to provide replacement water on a daily basis when it is needed by senior water users on the South Platte.

7 Agricultural Productivity - The authors of the draft EIS have expressed the principles governing the change or transfer of water rights. (Page 129). These principles relate primarily to protection of other appropriators from injury and maintenance of stream conditions. In order to prevent injury to other appropriators, it is necessary to mitigate the adverse impacts identified in the previous section of this report. One way of mitigating the adverse impacts is to pump non-tributary deep water. However, using Northglenn's maximum anticipated yield, only 2,300 acre-feet would be available, mitigating only a portion of the identified adverse impact of 5,500 to 6,000 acre-feet.

To provide additional augmentation or replacement water, Northglenn has purchased agricultural water rights. The process of acquiring agricultural water rights and drying up agricultural lands adversely impacts agricultural productivity. After reading Northglenn's water management reports and the draft EIS, the reader is left with the impression that Northglenn's plan will actually provide a benefit to

6. Yield studies of water rights along the South Platte River which will be incorporated into the Northglenn plan, have been made on a monthly and annual basis. Some of the rights in the plan are relatively senior while others are junior, and subject to being called out during certain portions of the year and in a dry year. Northglenn has the storage facilities available to divert water when it is in priority and store the consumptive use. This water can later be released to meet a call to protect out of priority diversions by the tributary well field or Grange Hall Creek. The operation of the plan to provide water on a timely basis to meet a call will be defined in the Water Court.

7. See the revised section of the Environmental Impact Statement on Agricultural Productivity. There is a moderate net benefit to agricultural productivity under the three options analyzed in comparison with the option four of condemnation of the FRICO system. Option 4 assumes the water required by the City in a dry year will be condemned or acquired. The balance of water remaining, approximately 1300 acre feet, is available for continued delivery to the farmers. This small quantity of water cannot efficiently be conveyed in a canal system designed for much larger capacities. Complete rennovation of the Bull Canal for a reduced capacity would be expensive and the remaining shares are likely to be sold thereby completely eliminating irrigated agriculture under the Bull Canal System.

agricultural productivity. For example, in the draft EIS the following statement is made on page 26: "The Northglenn plan is designed to provide a net benefit to agricultural productivity." As another example, in the preface to the "Northglenn Water Management Program" Volumes 1 and 2, the following statement is made: "By substituting cooperation for condemnation, Northglenn has designed a system capable of satisfying municipal water demands while keeping agricultural land in production." These statements, in our opinion, are misleading. The fact is that either condemnation or purchase of an agricultural water right and the subsequent dry-up of land will adversely impact agricultural productivity.

7 The "net benefit" reasoning used in the draft EIS is based on a comparison between drying up land under the Bull Canal that would be irrigated by 7,350 acre-feet in an average year versus drying up 1,260 acres of South Platte land. It was concluded that removing 7,350 acre-feet of farm headgate diversions from the Bull Canal would have a greater adverse impact on agricultural productivity than drying up 1,260 acres. Since drying up 1,260 acres was the "lesser of two evils," it was concluded that a net benefit results. In our opinion, a simple comparison cannot be made between these two alternatives. Drying up the land under the Bull Canal would produce a consumptive use of approximately 4,800 acre-feet which is almost four times greater than the consumptive use associated with the 1,260 acres of South Platte land. To use this type of reasoning, two valid and comparable alternatives must be used.

EPA Policy - According to an EPA letter dated September 8, 1978, from Douglas M. Costle, "It is EPA's policy to protect, through the administration and implementation of its programs and regulations, the Nation's environmentally significant agricultural land from irreversible conversion to uses which result in its loss as an environmental or essential food production resource." Either condemnation or purchase of agricultural water rights and the conversion to municipal use will result in the loss of irrigated agricultural land.

__Comparative Agricultural Productivity__ - Appendix A of the draft EIS gives a comparison between the agricultural productivity of the Bull Canal and the South Platte areas. Estimated 1979 crop values were compared for the two areas as shown in Table A-4 and A-5. The yields per acre as shown in these tables were obtained from the Weld County Extension Service and from Colorado Agricultural statistician, Lance Fretwell. The authors of the draft EIS assumed that these yields were representative of the Bull Canal and South Platte areas. We contacted Lance Fretwell and the Weld County Extension Service and were informed that the information that they provide is on a county-wide basis.

It is a well known fact by farmers in the area, that agricultural productivity under the Bull Canal is much lower than along the South Platte because the Bull Canal water supply is not adequate for the irrigated land. Even in an average year, FRICO only delivers about 50 percent of the water required to provide a full water supply for 8,345 acres. This lack of an adequate water supply is the primary reason that lands under the Bull Canal are not as productive as lands along the South Platte. In our opinion, the yields per acre tabulated on Table A-4 are not applicable to the water short area under the Bull Canal.

In order to verify this opinion, we obtained crop production information from several farmers with land under the Bull Canal and under the South Platte ditches and from other industry and government agency sources. Since 1979 was a very wet year, use of only 1979 crop production information does not give a realistic indication of average conditions. From the information that we derived for the period 1975 through 1979, the average productivity of the farms along the South Platte amounted to $650 per acre while the average productivity of lands under the Bull Canal averaged only $260 per acre. Generally, the crop production information we obtained came from well managed farms and, therefore, these values may not be representative of all farms along the South Platte or under the Bull Canal. The productivity of South Platte farms varies considerably depending on the type of crop grown. The productivity of the truck farms, some of which are included in the South Platte average productivity value, generally are very high. By using yields per acre that are more representative of the Bull Canal and South Platte areas, we determined the productivity for the land and crops tabulated in Tables A-4 and A-5. The resultant productivity of the Bull Canal area amounted to about $220 per acre and the resultant productivity of the South Platte acreage amounted to about $330 per acre. The South Platte acreage did not include any truck farms which accounts for the disparity between the $330 per acre and $650 per acre productivity values. However, both comparisons indicate that the productivity of South Platte lands is significantly greater than the productivity of Bull Canal lands.

In order to compare the alternatives of condemning FRICO land and water rights versus the purchase of South Platte land and water rights, it is necessary to present both alternatives using the same basis or foundation. Consumptive use is the best measure of a water right's value and change potential in the Water Court. For this comparative example, we have used 3,000 acre-feet as the required amount of consumptive use and we have estimated the consumptive use for Bull Canal lands at 0.8 acre-feet per acre and South Platte lands at 1.3 acre-feet per acre. In order to produce 3,000 acre-feet of consumptive use it would be necessary to dry up 3,750 acres of Bull Canal land or 2,310 acres of South Platte land is dried up, the adverse impact on agricultural productivity would be $762,000. If the unit consumptive use is only 1.0 acre-foot per acre (Page 39 as corrected) as estimated by the authors of the EIS, then the adverse impact on agricultural productivity from drying up South Platte lands would be $990,000. In other words, if a proper comparison is made of condemnation versus water rights purchases, it is found that the adverse impact on agricultural productivity is about the same.

MITIGATION OF IMPACTS

Steps to Minimize Adverse Impacts

8

Chapter 5 of the draft EIS addresses the subject of steps to minimize adverse impacts. However, the draft EIS in Chapter 5 does not consider any steps to minimize either the adverse water quantity impacts or the adverse impacts to agricultural productivity.

Net Adverse Impacts not Mitigated

Since the FRICO water will be used for irrigation in the future, this water is not available to mitigate the adverse impacts previously identified. By utilizing the remaining water supply sources identified on Figure 3-2 and Figure A-2, the total amount of water available for replacement according to the quantities presented in the figures is 2,079 acre-feet in a dry year and 3,083 acre-feet in an average year. Depending on the option selected, Northglenn may have zero, 650 acre-feet or up to 2,300 acre-feet of non-tributary deep well water that could be used for augmentation purposes. Northglenn does not have enough replacement water available to mitigate the adverse impacts previously identified. The net adverse impacts on an annual basis range from 600 to 3,500 acre-feet depending on the option selected and whether the year considered is wet or dry.

Adequacy of Water Rights

As explained previously, it probably will be necessary to perform a daily operation study of the water management plan in order to determine whether or not the water rights purchased along with additional water rights will be adequate to mitigate adverse impacts to other water users. The existing water rights are not adequate even if they produce the amount of water estimated by Northglenn.

At least some of the water rights may not be available for the purpose of mitigating adverse impacts. For example, for the Riethman Ditch in Civil Action No. 45,791 the court decreed as follows:

8. All four options identified have an adverse impact on agriculture with a larger impact by the condemnation alternative. Whether or not Northglenn has sufficient water to protect other water right users from injury will be a matter for the Water Court to decide. The Water Court will also determine whether or not the rights claimed by Northglenn to be used in the augmentation plan, such as the Riethman Ditch, can be used or not.

8

> ... when such water so diverted is not beneficially used upon the said one hundred and ninety-five (195) acres of lands described, the plaintiffs, their heirs, representatives and assigns, shall conduct or cause to be conducted such water to the South Platte River, by means of a ditch carrying the same directly back to said River, or the same shall be permitted to remain in said River at the headgate of said Burlington Ditch; that the water diverted under said priority shall at no time be permitted to flow down said Burlington Ditch, beyond or past the headgate of plaintiff's ditch or lateral, carrying water to said lands, and this decree is entered upon the express condition and it is so ordered and adjudged that the water diverted under said priority shall never be used, under such priority upon any lands, other than the one hundred and ninety-five (195) acres of lands above described; and, if and when the water diverted under this decree is no longer applied to said lands or needed therefore, this decree shall become void and of no effect, and no further water shall be allowed to be diverted under said priority, either at the headgate of said Burlington Ditch or through any other ditch, and it is now adjudged and decreed that the use of water, under said priority, upon any lands, other than the one hundred and ninety-five (195) acres of land above mentioned, would constitute a change in the conditions of the river and injury to the vested rights of other appropriators.

Although the Riethmann Ditch was adjudicated in a subsequent adjudication, the decree apparently mandates that the State Engineer shall administer the water right as if it were in the first adjudication, as long as the water is used to irrigate a specific 195 acres. This acreage is located between the Burlington Ditch and the South Platte River at the site which is now the Metro Sewage Treatment Plant. From an engineering point of view, it appears from this decree that Northglenn is prevented from changing this water right.

MISCELLANEOUS COMMENTS

9 1. Even if the water in storage within the non-tributary aquifer beneath Northglenn amounts to 230,000 acre-feet, more detailed engineering work needs to be done to verify whether or not Northglenn can feasibly pump 2,300 acre-feet each and every year for 100 years. What happens after 100 years?

10 2. Before the impacts of Northglenn's proposed tributary wells can be determined, Northglenn must determine where the wells will be located.

11 3. The impact of a shorter winter diversion season for the Croke Canal should be investigated. We have not reviewed the yield study prepared by Northglenn's engineers since that information is not available as of February 12, 1980.

12 4. Preliminary information indicates that the cropping pattern shown on Table A-5 may not be correct. Actually some of the farms purchased by Northglenn along the South Platte have raised truck crops such as potatoes and other vegetables. This should be verified since the crop value of vegetables is much higher than the crops represented in the draft EIS and since this would increase the adverse impact to agricultural productivity.

13 5. Northglenn apparently intends at times to continue to irrigate some of the South Platte lands. This will reduce the quantity of augmentation water available and could result in an expanded use of water which could adversely impact other water users on the South Platte. The resulting impact of this type of joint use should be investigated.

6. Farms under the Bull Canal rarely, if ever, receive the Great Western High Ten Growers award while several farms along the South Platte have received this award. This is another indicator

9. The actual quantity of nontributary water available to Northglenn, if any, is currently in the Water Court for decision. The amount of water physically available can only be determined after wells are completed and the aquifer characteristics have been determined. The nontributary aquifer beneath the City of Northglenn has a life of at least 100 years. Because there is only a fixed volume of water in storage in the aquifer there is a finite period of water availability. At such time as the water in the formation has been exhausted alternative supplies would have to be arranged.

10. See the revised write-up on the tributary wells in the final Impact Statement. The location of the well field has been determined and provision has been included to provide replacement water due to depletion of the tributary stream system by well pumping.

11. A possible shorter winter diversion season for the Croke Canal is a factor that Northglenn must consider.

12. A revised cropping pattern has been included in the determination of agricultural productivity in the final EIS.

13. Northglenn has indicated they will continue to irrigate some lands subject to water availability. Northglenn indicates the source of water for this irrigation will be from water already diverted and stored under the augmentation plan. Northglenn does not intend to irrigate only partially in a year and claim consumptive use credit for the balance of the year.

that the South Platte lands are more productive than the Bull Canal lands. Also, not much Coors barley is grown under the Bull Canal because an inadequate water supply adversely affects the quality of the barley.

ALTERNATIVES

In our opinion, Northglenn should consider other potentially viable alternatives for their water supply. These alternatives include the following.

Thornton

As stated in the draft EIS (Page 15), "Thornton also indicates that they are currently developing water resources outside of the Denver Metropolitan area to supplement their existing water supplies. The current position of Thornton is that they can provide an adequate water supply for themselves and Northglenn."

Deep Wells

Northglenn should consider the development of deep wells to be used for peaking purposes and to supply water on an interim basis until other water supplies such as transmountain water can be developed.

Denver Water Board

Our contacts with the Denver Water Department indicate that Denver has a large 60-inch water main in or near Northglenn that has additional capacity and could be used to supply Northglenn if water would be available. Mr. Bill Miller, manager of the Denver Water Board, indicated that Northglenn as well as other cities should consider joint development of Denver's future transmountain water projects. Development of these transmountain water supplies would have no impact on agricultural productivity since this is excess water that Colorado is entitled to by compact.

South Park Water

Thornton has concentrated its efforts in purchasing water rights in South Park to provide additional water supplies for Thornton. Northglenn should consider this alternative since it would probably result in a smaller adverse impact on agricultural productivity than drying up farms along the South Platte downstream from Denver.

Combination - Northglenn should consider combinations of the alternatives mentioned above.

SUMMARY AND CONCLUSIONS

1. The scope of our review and the comments contained herein were limited to the subjects of agricultural productivity, water quantity and water management plan alternatives.

2. Preparation of the draft EIS as well as our review was hampered by a lack of information concerning water quantity aspects of Northglenn's water management plan. Northglenn will not provide engineering studies concerning their analysis of the yield or historical depletion resulting from the utilization of their water rights until the studies are finalized. It becomes very difficult if not impossible to identify adverse impacts or determine the adequacy of mitigation efforts when engineering studies have not been finalized.

3. The direct impacts of Northglenn's water management plan can and should be identified and quantified apart from any resolution of legal issues. Secondary impacts upon agricultural procuctivity should be addressed assuming that Northglenn must mitigate all adverse water quantity impacts. Other assumptions concerning resolution of legal issues may also be made, providing the full range of possibilities is set forth.

4. The water quantity adverse impacts of Northglenn's water management plan range from 5,500 to 6,000 acre-feet per year. These impacts are caused by lining the Bull Canal, by Northglenn's consumptive use, by reuse of sewage effluent, and by the bonus arrangement made with FRICO.

5. We concur that more water will be required to mitigate adverse impacts on other water users. EPA should study the impact on agricultural productivity of providing this extra water.

6. Some of Northglenn's augmenting water rights may not be sufficiently senior to provide replacement water on a daily basis when it is needed by senior water users on the South Platte.

7. Either condemnation or purchase of agricultural water rights will adversely affect agricultural productivity by a similar amount. We disagree with EPA that a net benefit to agriculture will result from Northglenn's water management plan. A comparable analysis of the two alternatives must be performed to arrive at this conclusion.

8. We encourage EPA to review its policy concerning protection of agricultural lands to see if the adverse impacts identified herein on agricultural productivity comply with their policy.

9. South Platte lands are much more productive than Bull Canal lands because the FRICO water supply only provides 50 percent of the required water in an average year.

10. The draft EIS does not adequately consider the mitigation of adverse impacts on other water users and on agricultural productivity.

11. The net adverse impact of Northglenn's water management on other water users ranges from 600 to 3,500 acre-feet per year depending on the amount of deep well water developed.

12. It is necessary to perform an operation study of Northglenn's water management plan to determine the adequacy of their existing water rights as well as to indicate the additional quantity of water required.

13. Some of the water rights Northglenn intends to use for augmentation may not be available because of decree limitations or other possible limitations.

COLORADO PROJECT/T.I.P.

P.O. Box 731
998 SIXTH STREET
BOULDER, CO 80302
303-443-2471

21 February 1980

Mr. Wes Wilson
EPA, Region VIII
1860 Lincoln St.
Denver, Colorado 80295

Dear Mr. Wilson:

I am writing to encourage a positive declaration by the EPA regarding the proposed Northglenn Water Management Program. I have been following Northglenn's sewage plans for a long time, since being involved with the formation of the DRCOG Regional Task Force on 208 Planning, and the beginning of the statewide implementation of the 208 effort. I am encouraged by the thoroughness in planning and making recycling/reuse a prime energy conserving feature of the plan.

1 COLORADO PROJECT/TIP is a sister organization of the Technical Information Project Inc. TIP is a non-profit public interest consulting firm that specializes in the areas of resource recovery, energy policy analysis, waste and recycling.

The draft Environmental Impact Statement for the project, EPA 908/5-79-002A, thoroughly studies the project and properly concludes that the project qualifies for EPA funding. I believe that it correctly concludes that the innovative and alternate technology features of the project override any risks involved and that irrigation waters will be available for agricultural lands during the life of the project.

Sincerely

Philip S. Stern

Project Director

ENC. (1)

RESPONSE: 1. Acknowledge

THE FARMERS RESERVOIR AND IRRIGATION COMPANY
80 SOUTH 27TH AVENUE
BRIGHTON, COLORADO 80601
PHONE 659 [illegible]

DIRECTORS
ADOLPH BOHLENDER, PRESIDENT
CONRAD HERBST, VICE PRESIDENT
ALBERT SACK, 2ND VICE PRESIDENT
PAUL NORDSTROM, 3RD VICE PRESIDENT
M. H. KARSH
ALEX MILLER
LAWRENCE GERKIN

THOMAS G. FISHER
SUPERINTENDENT
CAROLYN S. FULTON
SECRETARY
GENEVA D. SANDUSKY
BOOKKEEPER

February 21, 1980

Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

RE: Draft Environmental Impact
Statement - Northglenn Water
Management Program
City of Northglenn, Colorado

Gentlemen:

This comment to the Draft Environmental Impact Statement for the City of Northglenn in the Northglenn Water Management Program is being submitted for inclusion in the record of written comments regarding the above-noted Draft Environmental Impact Statement.

The Farmers Reservoir and Irrigation Company supports the City of Northglenn in its request for grant assistance for the Northglenn water program. The Farmers Company believes that only through multi-purpose projects, of which the Northglenn project is a model, will irrigated agriculture continue to be a viable force on the front range of Colorado.

1 This comment is limited to one aspect of the Draft Environmental Impact Statement set forth on pages 89 and 90 with respect to a plan to prevent the public sale or distribution of raw edible food crops irrigated with the effluent water from the City of Northglenn.

[illegible] 26 1980

RESPONSE: 1. EPA, based on its independent analysis, has determined that sufficient level of pathogenic die-off occurs with the proposed system such that waterborne disease transmission by crop contamination is low. On a national level EPA has decided to issue specific guidance for necessary pretreatment prior to use of sewage effluent on raw edible crops. This effort is expected to take 2 to 3 years. At that point Northglenn, upon permit renewal will be required to comply with that guidance or if too costly impose a ban on raw edible crops as previously proposed. The agricultural reuse manual will contain an advisement against the use of this effluent on raw edible crops.

1 In large part, all of the water available for agricultural users in the South Platte basin, is reuse water. For many years, The Farmers Company, in its various divisions, and the other agricultural users of South Platte water, have utilized reuse water for general crop irrigation without adverse affect and without limitation upon the public sale or distribution of any food crops which are irrigated with predominately effluent waters.

The agreement between the City of Northglenn and The Farmers Company with respect to the use of water from Standley Lake provides that Northglenn shall return effluent of suitable quality to the shareholders of The Farmers Company. In conjunction with the governmental standards which will be imposed upon Northglenn, The Farmers Company believes that the standards for effluent water which will be established between Northglenn and The Farmers Company will be adequate to provide for the protection of public health. The Farmers Company therefore believes that requiring a plan to prevent the public sale or distribution of any food crops irrigated with the returned water from the City of Northglenn neither reflects the present status of irrigated agriculture on the front range of Colorado, nor is any such plan required to adequately protect public health.

The Farmers Company further believes that such a limitation upon the reuse of the waters from the City of Northglenn would not meet the standards of suitability which are called for in the agreement between the City of Northglenn and The Farmers Reservoir and Irrigation Company.

In considering the alternatives in the event that effluent waters are not directly used for irrigation, such waters will, in any event, be returned to the South Platte River from the City of Northglenn and all of the other municipalities in the Denver metro area; and such waters will continue to be withdrawn for the irrigation of general food crops without any specific limitation upon the public sale or distribution of crops grown. In such circumstances, The Farmers Company believes that it is preferable to provide for the direct reuse of the effluent waters from the City of Northglenn where both governmental and contractural standards will be imposed, rather than providing for the uncontrolled return of the effluent waters to the lower users in the South Platte River basin.

Very truly yours,

Adolph Bohlender

Adolph Bohlender
President
The Farmers Reservoir • Irrigation Company

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION EIGHT
555 ZANG STREET, BOX 25246
DENVER, COLORADO 80225

24187 February 21, 1980

IN REPLY REFER TO
HED-08

Mr. Roger L. Williams
Regional Administrator
U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

1 Thank you for the opportunity to review the draft environmental impact statement for the Northglenn Water Management Program in the City of Northglenn, Colorado.

We have no substantive comments to make on this document as highway transportation is not a significant issue in this water works project.

Sincerely,

F. A. Allison

for Daniel Watt
Regional Federal Highway Administrator

orig: BW
cy: RA, DRA, MO, RC

RESPONSE: 1. No response necessary

United States Department of the Interior
OFFICE OF THE SECRETARY
DENVER, COLORADO 80225

In Reply Refer To:
ER 80/66

24188

FEB 22 1980

264

RECEIVED
FEB 26 1980
EPA REGION VIII
Water Division

Mr. Roger L. Williams
Regional Administrator
U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

In response to your letter of January 11, 1980, requesting review and comment on the Draft Environmental Impact Statement, Northglenn Water Management Plan, Northglenn, Colorado, the Department of the Interior has reviewed the document and provides the following comments.

Fish and Wildlife

The document is not adequate regarding fish and wildlife resources. The information in the Draft Environmental Impact Statement (DEIS) is not sufficient to determine whether fish and wildlife resources will be affected by project construction and operation.

1 Fish and wildlife resources should have been discussed when addressing the lining of Bull Canal because reducing the seepage by 30 percent could be detrimental to fish and wildlife habitat. Mitigative measures may be warranted. The DEIS also is not clear regarding depletion of flows from the South Platte River.

2 We have learned from your agency that the existing South Platte flow regime will be modified below the tributary well field. The DEIS should define the stream reach affected, and describe how flow regimes will be changed. It is our understanding that contact has been made with the Colorado Division of Wildlife to resolve some fish and wildlife issues. The DEIS should discuss these issues and any impacts to fish and wildlife that would be associated with this proposed project.

3 The Endangered Species Act requires any Federal agency planning to construct, fund, or license a construction project to ask the Fish and Wildlife Service whether listed species or species proposed for listing occur within the area would be affected by the proposed project. If the

orig: BW
cy: RA, DRA, MO, RC

RESPONSE:

1. EPA recognizes that lining the Bull Canal may be somewhat detrimental to fish and wildlife resources. However, the lining of the Bull Canal is an independent action of a private enterprise and is not an integral part of the Northglenn project. Therefore, EPA will not be able to mitigate any impacts associated with lining of the Bull Canal.

2. Northglenn's proposal involves full augmentation of its South Platte, tributary waters and therefore the overall historic flow regimes will remain the same. Part of the stream reach, immediately below the tributary well field will have an insignificant reduction in flow. This reduction in flow is considered insignificant because Northglenn's purchase of water rights are sufficiently senior and will be utilized to replace well field depletions. Lining of the Bull Canal by FRICO will increase historical depletions, but this is a private action unrelated to EPA's or any federal action and is a question to be resolved in water court.

3 Service replies that such species may occur in the project area, the involved Federal agency must conduct a biological assessment. If the assessment reveals that listed species may be affected, the Federal agency is to consult with the Service, which in turn issues a written biological opinion on the project. These procedures should be discussed in the DEIS.

Ground Water

4 Because of the potential significance to ground-water resources, the specifics of the planned effluent disposal by irrigation of alfalfa should be more thoroughly discussed. We have questions concerning the discussion of acreage of alfalfa required to ensure continual disposal of wastewater-plant effluent (p. 91, 92). The probable volume of effluent that might be used on the 1,100-acre plot should be mentioned in the assessment. Typical depths of alfalfa roots in the general area and normal efficient rates of water application per acre for alfalfa should be indicated. These details are pertinent to the impact analysis. California tests of fine sandy loam grading into fine sand at depths of about 4 feet indicate that 95 percent or more of the alfalfa roots exist in the upper 5 or 6 feet of soil. Tests were made to determine efficient rates of water application, with the aim of avoiding loss of water below plant roots. It was found that application of 3 acre-feet per acre seemed to accomplish the most efficient use of the water applied and minimize loss below plant roots. On loam soils, 30 inches or 2.5 feet of water seemed to be sufficient for plant uptake. For sandy or gravelly soils, application of 4 or 5 acre-feet per acre was found most efficient (Young, A. A., 1945. Irrigation Requirements of California Crops. California Division of Water Resources Bulletin 51, p. 102-104).

Minerals

5 Known mineral resources of the project area and environs include coal, petroleum, natural gas, sand, and gravel. The DEIS mentions mineral resources (p. 49) but does not list the specific resources involved. The document also states (p. 50) that of the 10 sites evaluated for the storage reservoir, seven were rejected because they were "underlain by geologic faults, abandoned coal mines, natural gas lines, and/or economically recoverable mineral resources (Site 2 and Sites 4 through 9)."

Actually, coal underlies the accepted site as well as the nine rejected sites, and producing oil wells are within about one-half mile of the recommended site. Any future recovery of coal from beneath the site probably would not be affected because of its depth below the surface (about 2,000 feet) and the impervious clay lining planned for the reservoir. Moreover, any oil or gas occurring beneath the reservoir site likely could be recovered by directional drilling. Commercial sand and gravel deposits apparently do not occur within the reservoir site.

3. Consultation with the Fish and Wildlife Service indicates that the only possible impact on endangered species would be a consequence of South Platte River depletions affecting whooping crane habitat downstream in Nebraska. As explained under comment 2 above, EPA's action to approve the Northglenn project will not affect the South Platte flow regime. DOI may want to consider how the private actions of FRICO of lining the Bull Canal or any other private action may affect whooping crane habitat.

4. It is the intention of Northglenn to dispose of their wastewater on private farmlands irrigated under the Bull Canal which currently has 8,000 acres under irrigation. If there is insufficient private demand for this water Northglenn has agreed to develop a contingency plan to dispose of the effluent on City-owned land. A nitrogen balance was performed to determine the maximum loading in order to minimize this land requirement. With sufficient nitrogen uptake there is not expected to be nitrate infiltration into the groundwater. Execution of the contingency plan would require application to the State Department of Health.

5. Mineral resources which underlay the proposed site as well as other sites are discussed in the alternative site analysis section of the final EIS.

5 We suggest that subsequent versions of the document list mineral resources of the area, discuss their relationship to the storage reservoir, and state that minerals underlying the reservoir site could be produced, if necessary.

Historic Preservation

Copies of environmental documents should be sent to the Advisory Council on Historic Preservation rather than the "National Trust" (see Distribution, p. v). In addition, the comments of the State Historic Preservation Officer and/or the State Archeologist on the archeological survey should be included in the final statement.

Section 404 Permits

6 From the document we have not been able to determine whether a Section 404 permit will be required for all or portions of this project. This should be addressed in the DEIS. If a Section 404 permit is required, comments dealing specifically with the permit will be provided by the Area Manager, Fish and Wildlife Service, Salt Lake City, Utah.

In conclusion, we believe that the DEIS does not adequately cover the environmental concerns of the Department of the Interior. The comments discussed in this letter should be addressed in the final statement.

Sincerely yours,

John E Raybourn
JOHN E. RAYBOURN
Regional Environmental Officer

6. Northglenn has obtained all appropriate 404 permits necessary for construction of their proposed project. See response to comment 1, Corps of Engineer letter February 20, 1980.

City of Fort Lupton

COUNTY OF WELD

33[illegible] PARK AVENUE
P.O. BOX 158
FORT LUPTON CO 80621

FORT LUPTON 303 857-[illegible]
DENVER METRO 303 [illegible]
GREELEY METRO 303 [illegible]

24176

February 22, 1980

RECEIVED
FEB 26 1980
EPA REGION VIII
Water Division

259

Mr. Roger L. Williams
Regional Administrator
U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

Enclosed, the following comments, provided by the City of Ft. Lupton, concerning the Draft Environmental Impact Statement of the Northglenn Wastewater Management Plan and the February 13, 1980 public hearing on that plan.

1 1. Project Need. Northglenn contends that this project is necessary to provide its citizens with an acceptable water supply, i.e. Thornton cannot provide an acceptable water supply in terms of quantity or quality. Thornton says it can supply Northglenn with water sufficient to meet its current and future demands and that its water quality problem has been corrected. If the latter is correct, Ft. Lupton sees no need for this project. The applicant should be required to substantiate their contention and demonstrate actual need.

2 2. Project Funds. "In effect Northglenn's wastewater treatment need is entirely a function of the water supply and exchange program. In order to implement the exchange, control of wastewater treatment and discharge is essential". (draft E.I.S. p. 16) Ft. Lupton's position is that the granting of sewer construction funds should be predicated on a community's legitimate wastewater needs. The City suggests that the E.P.A. explore whether wastewater treatment needs - which are artifically generated as a by product of Northglenn's water supply and exchange program - constitute a legitimate need.

3 3. Scope expansion. Ft. Lupton is concerned with the operational aspects of this plan and their feasibility. It is a pertinent and appropriate area of inquiry and we request that the environmental impact study be expanded to include this aspect of the plan.

orig: EW
cy: RA, DRA, MO, RC

RESPONSE:

1. EPA acknowledges the fact that Thornton's existing water supply is acceptable, in terms of quality, to satisfy current drinking water criteria. Thornton has not demonstrated that their water resources, without additional expansion, are adequate to meet the future water supply need for both Northglenn and Thornton. Please refer to alternative water supply analysis.

2. Northglenn's wastewater treatment needs are a function of its future growth and are based on the prorata share of Denver Metro costs. While the wastewater treatment project is an integral part of Northglenn's water resource management plan, EPA has determined that the wastewater treatment need is sufficiently documented.

3. Additional analysis of the operational aspects of the plan has been conducted as part of the final EIS. This analysis indicates that potential problems may occur in meeting the suspended solid limit. If suspended solids concentrations violate permit limits, Northglenn is responsible for implementing operational controls to achieve permit requirements.

Mr. Roger L. Williams
Page 2
February 22, 1980

4 4. Legal Compliance. It is our understanding that at the February 13, 1980 public hearing, several parties raised the issue of E.P.A.'s procedural compliance with recently promulgated regulations covering the preparation of draft environmental impact statements. More specifically we are concerned that E.P.A. has not followed the "scoping requirements" of these regulations and is in violation of the law.

5 5. Water Supply Impact. It is the intent of the City of Ft. Lupton to evaluate and suggest the classification of the Bull Canal and the Coal Ridge Extension Ditch, including Sand Hill Lake, for the purposes of raw domestic water supply in the upcoming stream reclassification hearing of the Colorado Water Quality Control Commission.

The City of Ft. Lupton is concerned about the adverse impacts this project will have on the city and the surrounding region and is opposed to its construction. Therefore, until all problems are satisfactorily resolved we urge the E.P.A. to deny this fund request.

Sincerely,

William D. Hoffman, Mayor
City of Ft. Lupton

WDH/af

4. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

5. EPA concludes that since the Canal is not presently used for a domestic water supply, nor has there been any formal request to designate the Canal for domestic water supply, there is no need to protect the Canal for water supply.

268

FEB 27 1980
Water Division

GE1312

February 24, 1980
La Salle, Colo, 80645

Environmental Protection Agency
Region VIII,
1860 Lincoln St, Denver, Colo, 80295

24190

RE: Draft Environmental Impact Statement
Northglenn Water Management Program

As farmers, we depend on the re-use of sewage effluent for agricultural purposes to maintain the current agricultural economic standard of Colorado, to keep the Nation + the world fed, and balance the Nations deficits.

We support the growth of cities along the front range to meet the increasing population demands of the future of the State and expect the Cities to support agriculture.

We support optimum water management for domestic use, agriculture, Industry, Mining + Energy development.

orig: BW
cy: RA
DRA
MO
RC

1 Since Colorado is not in the fish industry, we ask that your guidelines be revised to keep Colorado viable and set aside safe waters for recreation. The South Platte has never been a recreation river.

The day has come, when all segments of the population must erase barriers + work together for the Survival of all.

Copy to Northglenn

Signed: Evelyn E. Krause
Henry Krause

RESPONSE:

1. Water quality standards and stream classifications are established by the Colorado Water Quality Control Commission and approved by EPA. The proposed South Platte River basin classifications and standards will be presented at public hearings during the summer of 1980. The public hearing process is the forum for presenting the public's desires.

WELD CO.
COLORADO

OFFICE OF BOARD OF COUNTY COMMISSIONERS

PHONE (303) 356-4000 EXT. 200
P.O. BOX 758
GREELEY, COLORADO 80631

24/183

February 24, 1980

RECEIVED 257
FEB 26 1980
EPA REGION VIII
Water Division

Mr. Roger L. Williams
Regional Administrator
United States Environmental
Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

RE: Approval of a Wastewater Treatment Facility Plan for a New Sewer Interceptor, Lagoon System, Storage Reservoir, and Agricultural Re-Use System for the City of Northglenn, Colorado

Dear Mr. Williams:

After reviewing the draft EIS which addresses the proposed Northglenn Water Management Program, and after attending the public hearings concerning this program, Weld County has a number of concerns which it feels must be addressed before the United States Environmental Protection Agency can consider awarding a construction grant for the development of the proposed Northglenn system. These concerns include the following items:

1 1. In letters to Mr. Roger Williams, Regional Administrator, EPA, from Gregory J. Hobbs, Jr., dated February 13, 1980, and February 12, 1980, it is pointed out that the Environmental Protection Agency has "intentionally and deliberately" violated the "scoping requirements" which are set forth in regulations of the Council on Environmental Quality at 40 C.F.R., 1500.1 et. seq., and 40 C.F.R., 1501.7 et. seq. It is Weld County's opinion that an important part of the preparation of a draft EIS has been ignored. Without such a process, there is no way of guaranteeing that critical issues will be addressed as the draft EIS is prepared. In reviewing the statement which has been issued by EPA, it would appear that several issues have not been given adequate consideration. Therefore, these comments should be considered as identifying issues as part of a "scoping process" as defined by CEQ regulations.

orig: BW
cy: RA, DRA, WO, BRC

RESPONSE:

1. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

Mr. Roger L. Williams
Page 2
February 24, 1980

2	2. In a review of the draft EIS prepared by W. W. Wheeler and Associates, Inc., issued on February 13, 1980, serious questions have been raised as to whether or not the Northglenn Water Management Plan is in reality, less detrimental to agriculture than the condemnation alternative. This report, as well as the draft EIS, reveal that the full implications of Northglenn's water supply system are not yet determined. Many of the implications of this system will be dependant upon decisions which have not yet been made by the courts. Further, questions have been raised as to whether or not the productivity figures used in comparing the impacts on the South Platte and FRICO land areas relate to the specific farmlands involved. The conclusions of the productivity analysis are thus at issue. Each of these questions has significant implications for the impacts which the project will have on agricultural productivity. For Weld County, this is a major question which must be more fully addressed before the project is funded. One of the major premises of the Weld County Comprehensive Plan supports the preservation of agricultural land as an important local, state and national resource. Thus, it is very important that the true impacts on agricultural productivity in the Weld County area be assessed.	2. EPA has revised the agricultural productivity analysis to reflect similar concerns raised by the Colorado Department of Agriculture. See revised Agricultural Productivity Analysis, Chapter 4.
3	3. It is pointed out in the EIS that the need for the treatment facility is basically a function of the water supply requirements of Northglenn and not a function of the need for additional treatment capacity. Given the use of other water supplies, other alternatives exist for the treatment of Northglenn wastewater. Therefore, one would assume that it would be appropriate and necessary to consider other alternatives to the Northglenn supply proposal within the draft EIS. A logical conclusion, which might be drawn from such an analysis, would be that alternative water supplies create a net benefit to agriculture. The existing alternative does not create a net benefit unless considered in comparison with the condemnation alternative. Weld County joins other concerned parties in asserting that a full evaluation of alternative water supplies has not been accomplished in the draft EIS. A thorough evaluation of reasonable alternatives is one of the basic requirements of federal regulations governing the development of Environmental Impact Statements (see Page 3 of letter to Mr. Roger Williams from Mr. Gregory J. Hobbs, Jr. dated February 13, 1980.)	3. Additional water supply alternatives for the City of Northglenn have been considered. An evaluation of these alternatives is presented in the revised water supply alternative section of the EIS.
4	4. Substantial portions of the draft EIS are devoted to the definition of mitigation measures which must be enforced if the Northglenn system is to be operated without significant impacts. Two mechanisms are relied upon by EPA to ensure that these mitigation measures are implemented by Northglenn. These include, (a) EPA grant conditions; and (b) the State enforcement	4. EPA concurs that grant conditions are difficult to enforce following wastewater facility construction. In order to secure additional responsibility and enforceability, EPA will negotiate with the Colorado Health Department to have several of these proposed grant conditions included as NPDES permit requirements. These include the following requirements: 200/100 ml fecal coliform limit in the effluent, disinfection of Dacono's nonpotable water supply, continuously control tailwater near the communities of Frederick and Firestone, as well as the requirement to limit new sewer taps based on DRCOG's population projections, and a ban on taps along the new interceptor. It is EPA's intention to require Northglenn to enter into an intergovernmental agreement with Weld County. EPA has not changed its required inclusions to the IGA. Northglenn has developed a draft IGA which is presented in Appendix K.

4 of NPDES permit requirements. EPA attempts to back up this enforcement mechanism by having the mitigating measures set forth in an inter-governmental agreement which is to be promulgated between Weld County and the City of Northglenn. In the latter instance, Weld County becomes an enforcement agency for the grant conditions and mitigation measures. Weld County seriously questions the effectiveness of the enforcement mechanisms which are relied upon to ensure that the mitigation measures are implemented. Once EPA has awarded the grant and the facility has been built, what authority does EPA retain to enforce the grant conditions? How many of the proposed mitigation measures can be made a part of the State NPDES permit under Federal or State law and thus part of a more effective mechanism for ensuring that the mitigation measures are implemented? If EPA and the State are unable or unwilling to provide an effective enforcement mechanism, Weld County might not choose to enter an inter-governmental agreement which establishes the County as the enforcement agency, which must spend substantial amounts of money to enforce grant conditions. It is Weld County's assertion that the mitigation measures and the ability of different agencies to enforce the conditions which are placed on the Northglenn system are factors which must be carefully reviewed in the Environmental Impact Statement process. It is felt that if these agencies cannot effectively enforce the grant conditions, this fact should be fully recognized by all parties involved, so that individuals do not assume that enforcement of conditions is available where such enforcement is unlikely.

5. In at least three instances, the mitigation techniques suggested to solve environmental issues are questionable. These include the following:

5a a) The EIS recommends that Northglenn control the distribution of edible food crops in the FRICO system which are irrigated by Northglenn effluent. Northglenn has even proposed that the City will buy those crops to prevent their public distribution if adequate markets are not available. It seems that this proposal is very unrealistic in terms of Northglenn's ability to actually secure adequate markets or to purchase the crops on their own. There has been no analysis done of the potential cost to Northglenn of purchasing such crops if markets are not available. Farmers under the FRICO system could reasonably choose to grow raw edible food crops in order to take advantage of a guaranteed market under the proposed conditions. It is Weld County's opinion that this particular mitigation technique is completely unacceptable in solving the problem of contamination of food crops by effluent from the Northglenn system.

5a. EPA has determined that it will not require Northglenn to restrict or control the distribution of raw edible food crops. This decision is not an endorsement by EPA for such use. The Agricultural Reuse Manual, to be prepared by Northglenn, will advise farmers against the use of effluent on raw edible food crops.

5b b) The draft EIS proposes that tail water control systems be constructed in the area of Frederick and Firestone to prevent the flow of effluent into areas where contact with humans would be possible. The full plans for such a system have not been discussed in the draft EIS. Further, it seems that there may be legal issues involved with the capture of such tail water and its ultimate distribution. These questions have not been addressed in the draft EIS. Finally, the draft EIS does not address how effective such a system would be in actually controlling the discharge of such waters to the cities of Frederick and Firestone. For instance, can it be assumed that the proposed plan will effectively control effluent under storm water run off conditions? Are there other conditions under which such a system might not work and what are the risks involved?

5c c) Finally, the draft EIS proposes that Northglenn will either treat the Dacono non-potable water system or will provide a replacement water supply for the Town of Dacono. The details of this plan have not been presented in the draft EIS. It is felt that this is an issue which must be considered in detail in the EIS and the effectiveness of such a system evaluated in depth. Finally, how can the full cost of this mitigation measure be evaluated if the full plan for such mitigation is not developed? How realistic are the costs figures for this project as included in the draft EIS?

5d d) In many of the suggested mitigation techniques, it is implied that Northglenn would in essence become the manager of a large agricultural land area. This seems to be assumed by the proposed measures related to the control of such factors are crop distribution and the control of the application of irrigation water to crops. Weld County seriously questions whether Northglenn has the ability to perform such a management function adequately. If Northglenn fails to carry out such mitigation measures, who is to pay the price in the long range?

6 6. In two instances, the draft EIS addresses the possible contamination of domestic water supplies through the discharge of effluent from the Northglenn system. These include potential domestic water supplies for both Fort Lupton and Frederick. In the case of Fort Lupton, EPA has concluded that the potential for contamination of Sand Hill Reservoir is very unlikely. In the case of the Town of Frederick, EPA has conluded that Frederick should secure another domestic water supply. It is felt that this poses a significant issue which the Environmental Protection Agency must address in terms of both this project

5b. Initial plans for the control of tailwater near the towns of Fredrick and Firestone are presented in the EIS. Whether such water may be legally reused in this manner is subject to water court decision. The effectiveness of this control is sufficient to prevent public contact with wastewater effluent. Stormwater will impose an additional loading on the control ponds, presenting the possibility that if irrigation preceded or occurred during a storm event diluted tailwater could enter the streets of Frederick or Firestone.

5c. Northglenn will be required to meet the NPDES permit conditions to disinfect or replace Dacono's nonpotable water supply system. Negotiations for this are the responsibility of Northglenn and will require acceptance by the Town of Dacono. Northglenn's projected cost of $50,000 is reasonable and acceptable to EPA.

5d. Northglenn will not be a manager of the agriculture reuse area. Rather it will develop an agriculture reuse manual. The purpose of which is to advise irrigators on appropriate management measures to utilize wastewater.

6. The State Water Quality stream classification process allows a community to request classification of waters for potential use as a water supply. Fort Lupton and Frederick have had this option to request such a classification of the Bull Canal for domestic water sources. Since Frederick has not sought formal reclassification of the Bull Canal for a water supply to this date nor investigated the use of the Bull Canal for this use, EPA has determined there is insufficient justification for delaying the Northglenn Proposal on this basis.

6	and in terms of future use of waters of the State. The issue, simply stated, involves determining how significant an investment has to be made in a given water supply to warrant protecting it for domestic use. In the case of Frederick EPA has stated that the water intended for domestic use was not formally designated as such. How much of a commitment does Frederick have to make in terms of that water supply before their concerns can be recognized? It is felt that this issue will not only arise in the case of the Northglenn project, but in the case of many other projects throughout the State of Colorado. In this sense, it must be fully addressed if the problem is to be solved.	
7	7. On Page 15 of the draft EIS, it is indicated that the annual growth rate for the City of Northglenn is expected to be 3.1 percent per year. It is also indicated that the population of the City in the year 2000 is projected to be 42,500. Based on the 1976 population figure of 32,000 and the expected rate of growth of 3.1 percent per year, Northglenn would reach a population of 42,500 by approximately 1987. The significance of these discrepencies should be analyzed to determine their effect on the basic assumptions made in terms of the need and design of the project.	7. Based on Northglenn's current population growth rate of 3.1 percent Northglenn would expect to reach a total population of 42,500 by the year 1990. Northglenn is a land-locked community. It has no ability to expand its boundaries, therefore, this population projection is also used for the year 2000. This population projection is also consistent with the DRCOG 208 plan.
8	8. The draft EIS states that a decrease in residential values adjacent to the site of up to 5 percent is possible if the facility is located at the proposed site. It is Weld County's contention, that if the facility is to be located as proposed, appraisals should be made both prior to location of the facility and after location of the facility to determine effects on adjacent residential property values. Northglenn should then be required to pay the property owners the difference in value between the two appraisals.	8. There is a potential for a decrease in residential property values adjacent to the site. However, EPA will not require Northglenn to make any compensation to the landowners for this potential decrease in property value.
9	9. Weld County disagrees with EPA's conclusion that the site for the proposed facility is acceptable (see Page 51 of draft EIS). In essence, EPA has basically accepted Northglenn's argument for chosing this site and it does not appear that EPA has fully evaluated Northglenn's site selection process.	9. EPA has conducted an additional site analysis. (See Chapter 3 for the analysis.) This analysis indicates there is no other more environmentally acceptable site available to the City of Northglenn for the wastewater treatment and storage facility.
10	10. The draft EIS addresses water quality effects on livestock on Page 56. The conclusion reached is that problems will not exist if effluent quality remains within recommended limits and proper management techniques are utilized to prevent nitritis. These statements raise two issues. First, if the effluent quality does not remain within recommended limits, who is to enforce those limits and what mitigation measures are to be utilized to reduce the problem? Second, are technicques such as the reduction of chemical fertilizers and the maintenance of aerobic conditions in stored silage, sound and feasible methods for controlling nitritis?	10. Nitrogen concentrations in the effluent and subsequent uptake and accumulation of nitrogen within silage crops is not anticipated to reach critical levels that would be detrimental to livestock. Therefore, it is felt that mitigation measures are not necessary to reduce nitrogen concentrations in crops. Nitritis is controlled primarily by maintaining aerobic conditions in storage silage. These methods are generally necessary in normal silage operations to prevent anaerobic conditions which would deteriorate the quality of the silage for livestock use.

11	11. The draft EIS addresses a concern relating to the control of weeds on properties owned by Northglenn within Weld County. It is Weld County's position that Northglenn must be required to pay for weed control on these properties.	11. Northglenn like any other property owner within Weld County will be required to control weeds on its property at their own expense.
12	12. On Pages 93 and 94 of the draft EIS conditions relating to a proposed monitoring system are set forth. It is stipulated that the monitoring program would be reviewed by the Larimer-Weld Regional Council of Governments and by Weld County before the monitoring program is approved by EPA. Weld County objects to being placed in the position of reviewing the monitoring program for any purpose if it has no authority to approve or deny the proposed program. By participating in such a review of the program, Weld County presents the appearance that it has authority where it does not. Finally, it seems that a mechanism should be established for independent analysis of the findings of the monitoring program by an agency or firm other than Northglenn, and that a provision be established which requires Northglenn to pay for such independent analysis.	12. Northglenn has developed based on an EPA requirement a proposal to monitor water quality in the canal and groundwater. This monitoring program is summarized in Chapter 5 of the final EIS. Under conditions of an intergovernmental agreement Weld County could obtain authority for an independent review of these water quality analysis. EPA does not have the authority to require Weld County to review or participate in the monitoring program. Rather EPA's intention is to provide information and to include Weld County as a participant in the monitoring program. If Weld County desires an independent check on water quality, analysis can be accomplished by allowing part of the monitoring program to be done by the Weld County Health Department. As recommended in the proposed intergovernmental agreement such costs would be refundable by the City of Northglenn.
13	13. The draft EIS has shown that Weld County will lose approximately $8,500 per year in taxes from lands which have been taken out of production as a result of the facility. It is Weld County's position that Northglenn must make payments in lieu of taxes for all lands taken out of production as a result of Northglenn land and water purchases in Weld County.	13. EPA recognizes that approximately $8500 in taxes could be lost as a result of the Northglenn plan. EPA will not require any mitigation of this loss.
14	14. At the public hearing on February 13, 1980, a representative of Great Western Sugar Company identified a concern related to algae growth in the storage reservoir. It was indicated that one of the main techniques for controlling such algae growth was through the use of copper. It was further indicated that copper concentrations can cause severe problems with sugar beet production. This problem must be thoroughly analyzed and proper precautions taken to insure that sugar beet production is not harmed as a result of the operational characteristics of the Northglenn system.	14. The City of Northglenn has considered controlling algal growth with applications of copper sulfate. EPA is concerned that improper application of copper sulfate could result in concentrations of copper that may be toxic to crops, particularly sugar beets. EPA recommends that Northglenn select other operational alternatives which will reduce algal concentrations and do not require the use of copper sulfate.
15	15. The draft EIS identifies several alternatives concerning the designation of a management agency or agencies, for the Northglenn facility. Weld County takes the position that it is the management agency for those portions of the Northglenn Water Management Program which are physically located within the unincorporated portions of Weld County and thus within the County's jurisdiction as 208 Management Agency. Northglenn could be designated as an operating agency for the sewage treatment facilities but it appears inappropriate to designate Northglenn as a management agency for the facilities located many miles from the City when the basic criteria for establishing management	15. It is EPA's position that Northglenn and Weld County should share management responsibilities and these management responsibilities shall be defined in the Intergovernmental Agreement, therefore, EPA will require, as a condition to the grant, that Northglenn execute an Intergovernmental Agreement with Weld County.

15 agency boundaries under the Larimer-Weld 208 Plan is the service area of a municipality. Furthermore, the City lacks the powers necessary as a management agency to control land use and non-point source pollutions sources outside of the service area of the City. If the facility is constructed, the relationship between the two governmental entities, as with entities within Weld County, should be set forth in an intergovernmental agreement between the City and Weld County.

16 16. The issue of the need for the project should have been carefully considered by the State Water Quality Control Commission during the process by which Northglenn was assigned its funding priority points. However, as discussed above, a review of the draft EIS indicates that the determination of need for the project is based on Northglenn's perception of the need for an independent municipal water system and not a need for a wastewater treatment facility. Given that the need for an independent water supply is doubtful in light of the City of Thronton's testimony at the February 13, 1980 public hearing, and the lack of any other evidence of the need for the project, Weld County respectfully requests that you hold a public hearing to review the priority points granted the City of Northglenn by the Water Quality Control Commission pursuant to 40 C.F.R., Section 35.915(g) and (h). This current environmental review process is, of course, dependant upon the request by the State for funding for the Northglenn project. A grant for the Northglenn facility based upon an invalid analysis of the need for the project would not be in accordance with the intent of the Clean Water Act and would do injustice to other communities of this State with a greater need for Federal assistance in building sewage treatment works.

This environmental impact statement process will be best served if these comments and the February 13 hearing are considered as a part of the scoping process so that a complete and detailed analysis of the environmental impacts of the Northglenn facility can be prepared. Within this context, the Board of County Commissioners wishes to thank you for your continuing attention to the concerns of this Board and the citizens of Weld County.

Respectfully submitted,

Board of Weld County Commissioners

C. W. Kirby, Chairman

Norman Carlson
Norman Carlson

Lydia Dunbar
Lydia Dunbar

Leonard Roe

16. With respect to the need for the facility and Thornton's position that they can independently supply water to the City of Northglenn, see water supply alternatives analysis in Chapter 3. EPA has determined that no particular benefit is gained by holding a separate public hearing on their decision. EPA will hold a formal public hearing on all aspects of the project as part of the final EIS process.

Richard D. Lamm, Governor

Colorado
Department of Local Affairs
Paula Herzmark, Executive Director

February 25, 1980

24185

Mr. Roger L. Williams
Regional Administrator
Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80203

Re: Draft Environmental Impact Statement
Northglenn Water Management Program

Dear Roger:

The Northglenn water management program draft environmental impact statement has been reviewed by State agencies as a major-action project. The following comments on the project are submitted by the Colorado Department of Local Affairs, as lead agency for the review, and reflect the collective views and concerns of affected State departments about the project and the Draft EIS. Individual State agency comments are also attached for your consideration.

The Water Quality Control Commission in endorsing the Northglenn water management program recognized it as a pilot project aimed at several "innovative" water resources management concepts, namely:

1. A direct provision of an available source of water without the substantial development of new sources;
2. A sharing or reuse of water between municipal and agricultural water users; and
3. An application of the land treatment alternative for wastewater on a relatively large scale.

Each of the above concepts is important and needs to be evaluated as Colorado, and the Front Range in particular, strives to provide water for expanding municipalities, while protecting the irrigated agricultural economy so important to the State and the region, and to improve the quality of water downstream from our major municipalities.

The State's review of the Draft EIS, however, has raised several key issues and concerns with the project and the EIS as follows:

orig: BW
cy: RA, DRA, MO, RC

1313 Sherman Street, Room 518, Denver, Colorado 80203 (303) 839-2771

1 1. In order to fully evaluate the need for such projects, comparative information must be provided for evaluating the cost and the feasibility of alternative methods of providing water supply and wastewater treatment for Northglenn. This evaluation should include, among other things, the potential for obtaining water and waste treatment from neighboring municipalities, increased importation of water to the area and its overall impacts on water quality and water use, and finally, the utilization of wells tapping bedrock aquifers.

2 2. Several state agencies which reviewed the Draft EIS have questioned the validity of the document's conclusions as to the overall impacts of the project on irrigated agriculture. Questions were raised regarding the net acreage lost or converted from irrigated to dry cropland. The change in value or net agricultural production as FRICO lands receive greater water application rates while the application rates along the South Platte decline was also questioned. We believe that a more thorough analysis in the EIS is required prior to formulating conclusions on the impacts on irrigated agriculture.

3 3. Concerns have been expressed by several State departments as to the appropriateness of expending limited Construction Grant funds, and indeed other public monies (Northglenn's taxpayers'), when alternative water sources and wastewater treatment facilities are available and at perhaps a lesser cost. While we recognize that the federal share of this project is approximately ten percent of the total cost, we question whether greater water quality benefits could be achieved by spending the Grant funds on other wastewater facility projects in the State.

4 In conclusion, we believe that the Draft Environmental Impact Statement for the Northglenn Water Management Program is not adequate for the State or EPA to fully evaluate the expenditure of Grant funds on a project that is aimed at demonstrating the utility and effectiveness of integrating water supply and wastewater treatment into a total water management program. We further believe that substantial supporting data is missing from the Draft EIS and must be presented in the Final. This is especially important due to the potential precedent application of the water management concepts fostered by this project.

The State will offer technical resources as they might be available and any data we may have as you consider the various alternatives. Please discuss

RESPONSE:

1. EPA concurs with these comments and refers the Department of Local Affairs to the revised alternatives analysis in Chapter 3.

2. EPA acknowledges these questions and refers the Department of Local Affairs to the agricultural analysis which has been revised.

3. EPA has not evaluated the Northglenn proposal to determine whether greater water quality benefits may be achieved by spending grant funds elsewhere in the State of Colorado. The analysis of grant funding and eligibility depends upon whether Northglenn's wastewater treatment facility is eligible under the Clean Water Act. The State Water Quality Control Commission has determined there are sufficient priority points to place Northglenn high on that list.

4. Supplemental information is presented in the final EIS to adequately evaluate the proposed project. EPA will be pleased to consult with the Department of Local Affairs upon your review of this additional information.

these possibilities and your requirements with our lead agency representative, Mr. Charles Jordan, Division of Planning 839-2351, who will coordinate other State agency input into the Final EIS. Finally, because of the significant policy issues surrounding the project, we request that EPA provide a 60-day review and comment period on the Final EIS. 5

Sincerely,

Paula Herzmark, Director
Colorado Department of Local Affairs

PH/ae

Comments attached from:
  Department of Agriculture
  Colorado Geological Survey
  Division of Water Resources
  Office of Energy Conservation
  Water Conservation Board

5. The Northglenn proposal has been the subject of considerable analysis during the last two years, therefore, EPA is not inclined at this time to grant the requested 60 day review period.

STATE OF COLORADO

DEPARTMENT OF AGRICULTURE
1525 Sherman Street
Denver, Colorado 80203
(303) 839-2811

Richard D. Lamm,
Governor

Morgan Smith,
Commissioner

Donald Svedman,
Deputy Commissioner

Agricultural Commission

Henry Christensen,
Roggen

Ben Eastman,
Hotchkiss

John Malloy,
Denver

Elton Miller,
Fort Lupton

Don Marchetti,
Center

William Stephens,
Gypsum

William Webster,
Greeley

Clede Widener,
Granada

Kenneth Wilmore,
Denver

MEMORANDUM

TO: Clearinghouse
Division of Planning

FROM: Morgan Smith
Commissioner
Department of Agriculture

RE: Draft EIS, Northglenn Water Management Program

DATE: February 22, 1980

While we commend EPA for attempting to analyze an extremely complicated issue on relatively short notice, we do not believe that this Draft EIS adequately answers or analyzes key issues pertaining to Northglenn's proposal.

EPA has a policy to protect environmentally significant agricultural land and refers to that policy on Page 26, stating as follows:

> "EPA has established policy designed to help protect environmentally significant agricultural lands (10). The policy is to protect significant agricultural land from irreversible conversion to uses which result in its loss as an environmental or essential food production resource."

This is a major undertaking. Protecting environmentally significant agricultural land is a highly complex and emotional issue. It is also a new issue about which there exists no major body of knowledge and successful experience. In addition, the Northglenn concept is a new one. As a result, this EIS is a test case for EPA as well as for the water sharing concept proposed by Northglenn. We have therefore tried to hold EPA to an extremely high standard as we have reviewed this Draft EIS.

EPA has not met that standard in two respects. EPA has not evaluated all alternatives to Northglenn's proposal. EPA's evaluation of agricultural productivity is not, in our judgment, adequate.

Our detailed comments are as follows:

FEB 25 1980
DIV. OF PLANNING

Page 2 - Memorandum - February 22, 1980
TO: Clearinghouse
Division of Planning

FROM: Morgan Smith
Commissioner
Department of Agriculture

RE: Draft EIS, Northglenn Water Management Program

1 1. Evaluation of Alternatives. The EIS states that Northglenn's position is that Thornton cannot provide an acceptable water supply in terms of quantity or quality. Thornton has, however, indicated that the water quality problem has been corrected and that they can provide an adequate water supply for themselves and Northglenn by developing water resources outside the Denver Metro Area (page 15). This conflict is not resolved within the Draft EIS. The Thornton alternative and its subsequent impacts should be discussed within the final EIS.

A second alternative is the possibility of some arrangement with Denver.

A third alternative, which is not fully examined, is the possibility of transbasin diversions. The EIS states that this alternative was dismissed on the basis of salinity and minimum flow concerns. While these are certainly two issues which must be considered, they must be weighed against other concerns such as the loss of irrigated cropland along the front range.

2. Evaluation of Agricultural Productivity. The conclusion of the EIS that this project should be supported by EPA appears to rest to a great extent upon the analysis of the agricultural benefits which will result from this proposed project. This analysis was based on the fact that productivity under the FRICO System is equal to $250 per acre-foot of water delivered and the productivity of the South Platte water is $109 per acre-foot of water delivered. There are several deficiencies in this analysis.

2a a. This analysis is based upon water diverted not consumptive use of the water by crops. EPA must realize (see page 129 of DRAFT EIS) that much of the water diverted is returned to the stream and used downstream by other irrigators when not utilized by crops during the first application. This is particularly true when a full supply of irrigation water is available as appears to be the case under the South Platte system, 2.75 acre feet of water per acre, as opposed to the FRICO system where land appears to be under irrigated, 1.04 acre-feet per acre of cropland. (Note: This was calculated by dividing water delivered, page 149, by irrigated crop acreages, Tables A-4 and A-5.)

RESPONSE: 1. EPA refers the Department of Agriculture to the water supply alternative analysis which has been revised and includes Thornton, Denver and trans-basin diversion alternatives.

2a. EPA agrees that agricultural productivity should also be evaluated in the context of consumptive use. This analysis has been conducted and is presented in the revised section on agricultural productivity of the final EIS. To further clarify EPA's previous analysis of agricultural productivity based on farm headgate deliveries the derivation of the analysis used in the draft EIS is presented below. All of the references to tables and page numbers are to the draft EIS.

1. Present Production and Yield

FRICO

Area irrigated in 1979 (Tables A-3 and A-4) 8,345 acres
Gross value of production (Table A-4) $2,164,000
Average gross value of production per acre

$$\frac{2,164,000}{8,345} = \$259.32/\text{Ac.}$$

Water released from Standley Lake(page 149) 14,425 acre feet
Headgate delivery@60% of release 8,655 acre feet
Headgate delivery per acre

$$\frac{8,655}{8,345} = 1.04\ \text{AF/Ac.}$$

Gross Value of Production per acre foot of headgate delivery

$$\frac{2,164,000}{8,655} = \$250.03/\text{AF}$$

Report uses $250.00/AF (page 149)

South Platte

Area irrigated in 1979 in sample area (Table A-5)1,158 acres
Gross value of production (Table A-5) $349,540
Average gross value of production per acre

$$\frac{349,540}{1,158} = \$301.85/\text{Ac.}$$

Headgate deliveries (page 149) 3,192 acre feet
Headgate delivery per acre

$$\frac{3,192}{1,158} = 2.76\ \text{AF/Ac.}$$

Gross Value of Production per acre foot of headgate delivery

$$\frac{349,540}{3,192} = \$109.51$$

Report uses $109 (page 149)

2. Value of Production

FRICO

The value of production in the FRICO System for lands controlled by FRICO farmers and Northglenn was determined for four options. The calculations for Option 1 in an average year are shown below.

Water available to land (Figure 3-2)

Releases from Standley Lake	5,953 AF
FRICO exchange return	6,297 AF
	12,250 AF

Headgate delivery at 60% of release = 7,350 AF
(this value shown in Table 3-5)
Gross Value of Production (7,350) (250) = $1,837,500
(this value shown in Table 3-7)

South Platte

The value of production of the lands taken out of production in the South Platte was determined for four options. The calculations for Option 1 in an average year are shown below.

Total Augmentation Requirements (Table 3-4) 1,332 acre feet
Total acres to be dried up at a depletion rate of 1 acre foot/acre 1,332 acres
(Note-this computation is not discussed in the report but the value of 1,332 acres is shown in Table 3-6)
Water removed from currently productive land (Table 3-6) 1,260 acres
(The water had been removed from the Reithman Ditch land prior to 1979 so this was subtracted from the gross requirement. The depletion study by Wright indicated a depletion of 72 acre feet for this area in an average year)
Gross Value of Production

$$\$109/\text{AF of headgate delivery} \times 2.76\ \frac{\text{acre ft}}{\text{acre}} \times 1,260\ \text{acres} = \$379,058$$

(this value shown in Table 3-7)

Page 3 - Memorandum - February 22, 1980
TO: Clearinghouse
Division of Planning

FROM: Morgan Smith
Commissioner
Department of Agriculture

RE: Draft EIS, Northglenn Water Management Program

2b b. The EIS also assumes (Table 3-7) that this relationship of $250 per acre-foot of water to $109 productivity per acre-foot of water delivered remains the same regardless of the amount of water added or removed on a per acre basis. This is an incorrect assumption. The marginal value of an acre-foot of water delivered is not a constant as the EPA assumes but rather there is a decreased economic benefit for a second acre-foot of water as opposed to the benefit derived from the first acre-foot of water. (See attachment Figure 1). Because of this, Table A-7 is incorrect and any decisions based upon this analysis will be misleading.

2c c. A comparison of the productivity of the irrigated FRICO lands and the South Platte lands should be included in this analysis. An example of productivity (Tables A-4 and A-5) is the fact that it takes 140 acres of land under the FRICO System to grow the same corn from grain (the major crop under the FRICO System) as can be grown on 100 acres on the South Platte lands.

An attempt by our department to verify the yield per acre figures displayed in tables A-4 and A-5 was unsuccessful. Personal communication with the sources listed for this information (Director of the Weld County Extension Office and Lance Fretwell, Colorado Agricultural Statistician) revealed that neither has subcounty yield information, and neither knowingly provided EPA with such information. Our department believes that yields under the FRICO System may in fact be lower than actually described due to the lack of adequate irrigation water. If, however, EPA believes these yields are correct, it should verify the source of this information and describe how such subcounty data was derived.

2d d. An analysis of the soils and accompanying maps of the South Platte lands, which will be taken out of irrigated production as a result of this project, are needed. The Important Farmlands Map for Weld County is presently being published by the Soil Conservation Service and should assist EPA in this effort.

2b. EPA recognizes that only marginal benefits are realized in the application of additional water. EPA considered the value of adding additional water to the South Platte system and concludes that the marginal benefits that could be realized are incrementally small relative to the additional amount of water available so that no measureable economic change can be added to the analysis.

2c. EPA considered doing comparative productivity analysis for the agricultural lands involved. However, EPA determined that it is sufficient to analyze the net economic value of productivity as a result of water delivered or eliminated from agricultural lands. EPA's consultant contacted the Colorado Agricultural Extension Service as well as the Soil Conservation Service in order to secure this information. Subsequent data sources have been contacted and include farmers along the South Platte River and Dr. Ray Anderson who has completed studies of the FRICO system. Based on supplemental findings, a revised productivity analysis is incorporated into the final EIS.

2d. EPA would like to acknowledge receipt of the prime agricultural land maps and has incorporated them into the EIS evaluation of agricultural productivity.

Page 4 - Memorandum - February 22, 1980
TO: Clearinghouse
Division of Planning

FROM: Morgan Smith
Commissioner
Department of Agriculture

RE: Draft EIS, Northglenn Water Management Program

3 3. Production of Vegetables and Sugar Beets. The EIS states that Northglenn has agreed to purchase any vegetables grown under the FRICO System which are not suitable for direct human consumption as a result of this project. Is this agreement legally binding for the life of this project?

The EIS also states that high levels of nitrogen may harm sugar beets if applied after July 15th. EPA recommends that since nitrogen levels in the water will be high as a result of this project, proper management of water applications must occur. However, in order to produce a crop of sugar beets several water applications must be applied after the 15th of July. Would seven or eight water applications of high nitrogen water after this date affect the yields or quality of a sugar beet crop? If it does, will Northglenn take the responsibility for compensating agricultural producers for their losses?

3. EPA has determined Northglenn will not be required to control distribution of raw edible food crops grown under the FRICO system thus this item is no longer applicable. With respect to high levels of nitrogen that may harm sugar beets see the comments of the Great Western Sugar Company. Great Western Sugar Company indicates that proper application of this effluent should have no adverse effect upon the sugar beet crop.

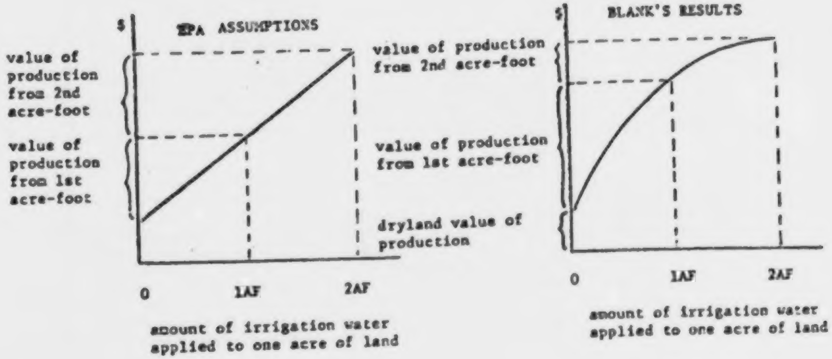
4 4. Water Conservation. The specific actions which Northglenn will impose in order to conserve water, and thereby prevent the loss of water for agricultural use, should be described in detail in the Final EIS.

4. Northglenn intends to dispose of its wastewater effluent by discharging into the Bull Canal and allowing private use by individual farmers. It is the responsibility of these farmers to develop appropriate conservation of their water use and not the responsibility of the City of Northglenn. Northglenn is developing a procedure as described in Chapter 5 to implement water conservation within their community.

We do not intend these comments to be a criticism of Northglenn's efforts or an indication of opposition to the project. We believe, however, that additional work must be done by EPA on this Draft EIS. We would be glad to offer our assistance in that effort.

MS:mlb

ATTACHMENT



Source: Blank, Herbert. "Optimal Irrigation Decisions with Limited Water"
Ph.D. Thesis, Colorado State University (Civil Engineering). October 1975.

MEMORANDUM

OFFICE OF ENERGY CONSERVATION
1600 Downing Street, 2nd Floor
Denver, Colorado 80218
Phone (303) 839-2507, 839-2186

DATE: February 11, 1980

TO: Colorado Clearinghouse

FEB 11 1980
DIV. OF PLANNI

FROM: Office of Energy Conservation

SUBJECT: Northglenn Water Management Program
City of Northglenn, Colorado #80-102

The Office of Energy Conservation has reviewed the City of Northglenn Water Management Program and offers the following comments.

1 This program for integrated sewage treatment and waste water recovery favorably explores many energy conservation considerations. Northglenn has taken several positive steps including: initiating a tap management system which will help to control future patterns of development; discouraging non-contiguous development; proposing land use and zoning regulations which will help to mitigate detrimental effects of increased water availability; and a graduated water rate scale which provides higher fees for higher residential usage rates. By recycling partially treated water to agricultural uses, nutrients are returned to the land, reducing dependence on petroleum-based fertilizers. This also reduces the demand for energy consumptive treatment processes.

In new building construction at the treatment site, passive solar energy systems will be utilized and further energy efficiency will be possible by earth-sheltering part of the building. In designing the aerator system, wind power has been evaluated. Although wind was not considered feasible for the site at this time, this office encourages continued exploration of such renewable energy options.

Recycling plays an integral role in this program. Some of the existing Thornton system facilities will be rehabilitated for use by the system, thus reducing the higher energy demands of new construction.

RESPONSE: 1. EPA acknowledges that Northglenn is to take several positive steps to conserve energy.

2 A population projection of 42,500 for the year 2000 is cited, although the ultimate population figure is given as 48,000. What additional facilities will be necessary to provide for this eventual demand? Specific electrical power requirements for the system were not cited, nor was the power source mentioned. Can existing power facilities accommodate the Northglenn system's requirements?

Several lawsuits affecting the project are still pending. Flexibility should be built into the program to accommodate any changes possibly to be required by the courts.

2. Total power requirements for the facility and the comparison with Northglenn's pro-rated power requirements with Denver Metro wastewater facility are presented in Chapter 4. Northglenn's ability to change water rights by utilizing water tributary to the South Platte or deep nontributary wells gives them a flexible system. The ultimate water sources for their project will depend upon determination made in the water court.

RICHARD D. LAMM
Governor

J. A. DANIELSON
State Engineer

DIVISION OF WATER RESOURCES

Department of Natural Resources
1313 Sherman Street - Room 818
Denver, Colorado 80203
Administration (303) 839-3581
Ground Water (303) 839-3587

February 13, 1980

MEMORANDUM

TO: MARGIE KAMINSKY, STATE CLEARINGHOUSE

FROM: HAL D. SIMPSON, CHIEF, WATER MANAGEMENT BRANCH

SUBJECT: NORTHGLENN WATER MANAGEMENT PLAN - DRAFT EIS

1 This is to acknowledge receipt of the above referenced document which evaluates the environmental impacts of the Northglenn plan. We have carefully reviewed the report and believe that it adequately discusses the water resource related impacts and issues of the proposed plan.

The issues related to such factors as augmenting South Platte River depletions resulting from transfer of wastewater from the Thornton enclave (895 acre-feet per year) to the Bull Canal, augmenting the South Platte River for sewer system infiltration (300 acre-feet per year) which will be transferred to the Bull Canal, and other issues as set forth on pages 32 and 33 will be decided by the Water Court when the plan for augmentation and applications for change in water rights are heard by the Court. It is possible that Northglenn would be required to obtain additional water resources to provide augmentation water for these depletions.

The use of non-tributary ground water as a source of water which would reduce the amount borrowed from FRICO is also subject to a decision by the District Water Court since Northglenn has appealed the denial of the well permits by this office. If the Court upholds the denial, then Northglenn would be required to utilize the South Platte River water rights it has acquired in order to augment the well field depletions.

The measures required to prevent ground water seepage and contamination appear adequate if properly inspected. This office would be willing to aid

FEB 14 1980
DIV. OF PLANNING

RESPONSE: 1. EPA acknowledges that the State Division of Water Resources finds the draft EIS adequate to discuss water resource-related impacts and issues of the plan.

in the inspection of the cut-off key for the earth embankment to determine if fault traces cut across the reservoir.

Hal D. Simpson
Hal D. Simpson

HDS:mvf

cc: Jim Clark, Div. Eng.
Bill McDonald

STATE OF COLORADO

RICHARD D. LAMM
Governor

JOHN W. ROLD
Director

COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
715 STATE CENTENNIAL BUILDING – 1313 SHERMAN STREET
DENVER, COLORADO 80203 PHONE (303) 839-2611

February 1, 1980

Mr. S. O. Ellis
Colorado Clearinghouse
Colorado Division of Planning
1313 Sherman Street
Denver, CO 80203

Dear Mr. Ellis:

RE: NORTHGLENN WATER MANAGEMENT PLAN EIS

1 We have received and reviewed this I.I.S. In most respects geology has little direct bearing on this project. The respects that do (water quality and availability) are regulated by other agencies or local jurisdictions. If, in the construction phases of this project, engineering-geologic data and/or advice are needed, then the C.G.S. is available to offer limited assistance.

RESPONSE: 1. Acknowledge.

Sincerely,

James M. Soule
James M. Soule
Engineering Geologist

JMS/gp

cc: Land Use Commission

FEB 04 1980
DIV. OF PLANNING

GEOLOGY
STORY OF THE PAST . . . KEY TO THE FUTURE

BENJAMIN F. STAPLETON
Chairman, Denver
FREDERICK V. KROEGER
Vice-Chairman, Durango
JOHN R. FETCHER
Steamboat Springs
C. M. FURNEAUX
Walden
FLOYD L. GETZ
Monte Vista
PATRICK A. GORMLEY
Grand Junction
ROBERT A. JACKSON
Pueblo
DAVID LEINSDORF
Crested Butte
HERBERT H. VANDEMOER
Sterling

RICHARD D. LAMM
Governor
DEPARTMENT OF NATURAL RESOURCES
COLORADO WATER CONSERVATION BOARD
823 STATE CENTENNIAL BUILDING
1313 SHERMAN STREET
DENVER, COLORADO 80203

J. WILLIAM McDONALD
Director
LAREN D. MORRILL
Deputy Director

TELEPHONE
(303) 839-3441

February 15, 1980

MEMORANDUM

FEB 15 1980
DIV. OF PLANNING

TO: Colorado Clearinghouse
Division of Planning

FROM: Daniel L. Law
Water Resource Specialist

THROUGH: Bill McDonald, Director

RE: Northglenn Water Management Plan
Draft Environmental Impact Statement
#80-102

1 The Colorado Water Conservation Board supports the concept of agricultural reuse of municipal effluents to provide a high degree of treatment for such wastewaters. However, regardless of which treatment technology or source of surface water rights is utilized, the City of Northglenn will necessarily deplete the flows of the South Platte River by its consumptive use. Thus, while FRICO's water use will be unaffected, this project will have to take irrigated agricultural land out of production along the South Platte River immediately below Denver. In short, a successive use plan such as this cannot avoid a net reduction in irrigated acreage so long as surface water is used by Northglenn.

The Board has the following comments on the Draft Environmental Impact Statement:

2 1. According to the Land Use and Facility Map in the report, approximately 1300 to 1400 acres of irrigated farmland along the South Platte River will either be taken out of production or changed to dry-land farming. In addition, approximately 400 acres of irrigated farmland in the Big Dry Creek basin will be taken out of production or switched to dry-land farming. The total amount of irrigated land taken out of production or switched to dry-land farming could total 1800 acres, with no increase in acreage expected

RESPONSE:

1. EPA acknowledges the net reduction in irrigated acreage will occur as a result of withdrawal of surface waters in the South Platte River. The withdrawal of surface waters is necessitated by Northglenn's self-imposed requirement to replace water that would be exchanged with the Farmers Reservoir and Irrigation Company (FRICO). EPA's agricultural analysis compares the consequences of a successful condemnation of FRICO water to the proposed Northglenn-FRICO exchange to determine which will maintain the highest agriculture production. The result of the analysis is that less irrigated acreage would be taken out of the production with the exchange than would occur if condemnation were successful.

2. EPA acknowledges that up to eighteen hundred acres could be converted from irrigated farming to dry land farming. It is possible that no increase in irrigated acreage would result from this exchange. However, FRICO farmers have the option to either expand their acreage or to increase the amount of water applied on their existing irrigated land.

Colorado Clearinghouse
February 15, 1980
Page two

for the FRICO system.

3 2. The net benefits for the FRICO system are stated in the report at $250 per acre-foot of water delivered at the headgate, while on the South Platte it was stated to be $109 per acre-foot. These figures are based on 1979 statistics. Such a substantial difference is questionable. While these results were based on headgate quantities, the consumptive use of water for the various crops should not differ by more than a few percent. Much of the water applied on the South Platte lands runs off to supplement other irrigator's supplies or recharges the groundwater table. It would be more desirable to determine the net benefits from a 5 year period using the consumptive use values and from areas of comparable size (Net benefits were computed on a basis of FRICO-10,000 acres and South Platte-1000 acres). In addition, the tailwater recovery and groundwater recharge systems of the South Platte area should be analyzed to see how many additional acres are irrigated from the original diversion.

4 3. The utilization of 885 acre-feet of water from Thornton's enclave along with the 300 acre-feet from sewer infiltration in the augmentation figures seems optimistic. If these sources were denied by the courts, a substantial amount of irrigated land in addition to the 1800 acres specified above, would have to be taken out of production to meet this increased need.

5 4. The paragraph on page 8 itemizing annual net benefits ($1,180,000 vs. $460,000) is misleading. For one thing, the net benefits are stated in terms of a dry year, while the values were calculated using 1979 statistics, which was not a dry year.

6 Further, the comparison is made identifying the augmentation process versus the condemnation process, but no net benefit was given to the status quo alternative. It would appear that the net benefit would be negative when compared to the status quo since up to 1800 acres of irrigated farmland would be taken out of production and no new land added. Although a more reliable system is established for

3. The agricultural productivity analysis has been revised include a comparison of productivities using crop consumptive use values. See response to Department of Agriculture.

4. EPA recognizes that if the court denies the utilization of the 300 acre feet which comes from sewer infiltration Northglenn will have to obtain makeup water from some other source. That source could either be irrigated agriculture or, alternatively, nontributary deep wells.

5. The intent of the comparison of net annual agriculture benefits is to indicate the range of benefits that might result from the Northglenn plan. It is acknowledged that these statistics were determined using 1979 values. These values were then applied to the amount of water delivered through the system during the dry year.

6. As Northglenn has entered into various agreements and intends to complete its plan with or without federal money, the execution of the proposed plan can be considered the status quo alternative. The results of the agricultural productivity analysis indicate the condemnation of this water has less agricultural benefits than the status quo.

> FRICO and also a higher yield per share would result, the net benefits per acre-foot would more than likely decrease since the crop yields would not necessarily increase in proportion to the additional water available.

It is imperative that these analytical errors be corrected in order to provide accurate information prior to a final decision on the alternatives.

DLL:pm

STATE OF COLORADO
Richard D. Lamm, Governor
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE
Jack R. Grieb, Director
6060 Broadway
Denver, Colorado 80216 (825-1192)

February 21, 1980

TO : Stephen O. Ellis
Colorado Clearinghouse

FROM: C. J. Grand Pre CJ
Sr. Wildlife Biologist

SUBJ: Northglenn Water Management Plan

We have reviewed the above-cited proposal and find it to be inadequate. There are several items that need further consideration.

1 In conversation with the City of Northglenn we find that the City is aware that certain losses of wildlife and wildlife habitats will occur as a result of developing their proposed sewage plant. In addition, we find that the City has proposed an extensive waterfowl development, open space and revegetation project as mitigation for those losses.

Wildlife is an extremely important natural resource. We feel it imperative that impacts upon wildlife, wildlife habitats, and measures to mitigate those impacts be reaffirmed and addressed in the environmental impact statement.

/d
cc: EPA
Dept. of Health
USF & WS,SLC
NE Region
File (2)

FEB 25 1980
DIV. OF PLANNING

DEPARTMENT OF NATURAL RESOURCES, Harris Sherman, Executive Director • WILDLIFE COMMISSION, Michael Higbee, Chairman
Wilbur Redden, Vice Chairman • Sam Caudill, Secretary • Jean K. Tool, Member • Vernon C. Williams, Member
James Smith, Member • Donald Fernandez, Member • Richard Divelbiss, Member

RESPONSE: 1. EPA did not evaluate the possible impacts to wildlife and wildlife habitat because no significant impact could be determined. The City of Northglenn is proposing extensive open space programs which would include its Stonehocker Reservoir development plan. However, the Stonehocker Reservoir is an independent recreational development by the City of Northglenn and is not part of this proposal. The City proposes to revegetate the project site which would include replacement with trees, shrubs, and grasses. The City had proposed an island be constructed within the wastewater storage reservoir. This proposed island, which may be attractive to water fowl, creates the potential of encouraging additional coliform contribution to the reservoir. This complicates the monitoring of pathogenic indicators in the effluent. This island has been eliminated from the reservoir. It is likely that wildlife benefits will be realized through the construction of the proposed Grange Hall Creek stormwater runoff detention pond which will provide some level of aquatic and wetlands habitat.

February 25, 1980

24191

Mr. Roger Williams, Administrator
Region VIII
U.S. Environmental Protection Agency
1860 Lincoln Street
Denver, CO 80295

RE: Comments on EIS/Northglenn Water Management Program

Dear Mr. Williams:

The following comments are in response to the Northglenn Draft EIS.

The innovative and alternative provisions of the Clean Water Act of 1977 emphasize the planning, design and construction of cost effective municipal treatment works that maximize the recycling and reclamation of water and nutrients while minimizing energy use and adverse environmental and public health impacts. So, elimination of risks is neither expected under PL-95-217, nor is it practicable because they are inherent in any emerging technology. The Northglenn project has several features which are specifically aimed at reducing these risks to an acceptable level and certainly reduce risk levels below existing sewage treatment plants in the Denver area.

The question of public health risks are greatly distorted because of attitudinal differences in terms of certain selected psychological dimensions: (1) Fear of contact with impure or dangerous substances; (2) Progressive versus traditional stance; and, (3) Revulsion to body waste tendency. Given the complexities involved in setting tolerance levels for specific contaminants that might appear in a renovated water, such an approach might take a long time to develop and even in that case EPA might be faulted for not covering all possible effects.

A complementary and perhaps more productive approach would be to conduct a rigorous analysis based on state of the art, which EPA has amply demonstrated in its assessment. Also, this author is cognizant of the fact that reclaimed water for second order uses, when designed properly, will in all probability provide a better product than that used in a number of public water supply systems, particularly those with inadvertent reuse in the South Platte Basin.

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Orig: BW
cy: RA
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RC

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FEB 27 1980
Water Division

RESPONSE:

1. EPA acknowledges these views by the City of Northglenn - the topics of public health risk, options of reuse within the semi-arid west, utilization of irrigation canals and domestic water source and the public attitudes on public health concerns are addressed in the final EIS.

There must be a breakthrough in the sacrosanct status of a single grade water for the wide discrepancy of urban and rural uses. Utilization of a hierarchy of water supply would, by allocating reclaimed water to the lower order needs that constitute the bulk of demand, release the potable water supply for future expansion. Sections 201 and 208 of PL 92-500 which call for Facility and Areawide Wastewater Management Planning, provides an unparralled opportunity which was obviously utilized in the Northglenn project. But unless federal leadership is forthcoming, it is unlikely that extensive use of these provisions for a multifaceted approach to water supply and water quality planning will receive more than polite attention.

Environmental demands on water management systems heightened the perception of utility of wastewater reclamation, which should be exploited by the agency. I believe that in the semiarid western states, where water purveyors are mulling over appropriation doctrines and a myriad of state and federal laws, EPA has a unique responsibility to encourage water supply - wastewater treatment coordination and better management of water resources. When the sources of supplies are restricted, traditional demarcations between water supply augmentation and pollution abatement become invisible. Conjunctive use of surface and ground water supplies and storage water supplies and storage capacity should be encouraged to maximize yield and improve water quality.

If the United States, as a nation, is to develop a technology in anticipation of eventual potable use of renovated wastewater, indirect or successive use as contemplated in the Northglenn project must be encouraged and fully developed first. The impetus for innovation for re-use will come chiefly from the technical-managerial community, based on accummulated experience provided by indirect recycling of water use with new technological systems. Equally obvious are the potential contributions to the field of re-use in the areas of costs, management techniques and the level of public acceptance.

In the light of Safe Drinking Water Act requirements on trihalomethanes and synthetic organics, it is highly questionable whether irrigation canals can be a viable source of drinking water supplies. Because of non-point source pollution from return flows, it is quite possible that these sources would require adsorption technologies in water treatment. Removal costs of nitrates due to sewage effluent would be relatively minor compared to the extremely high cost of the adsorption technology.

Accustomed to an orderly administration process of water supply augmentation, the farmers and other interests suddenly found themselves squarely in the middle of heated battles which frequently turned on issues ranging from heavy metals to viruses. For its part, the public often appears content to delegate decision making power to professionals and specialists. And there is evidence that conservative attitudes of public health concerns are in conflict with beneficial effects of alternative technologies. What is needed is quick and effectual attention to the relevant issues and swift decisions to clear up the trivial issues.

The author firmly believes that the Northglenn project deserves the grant award and prompt action by EPA, to provide an impetus for innovative and alternative technologies enunciated in the Clean Water Act, for the following reasons:

a) The project provides a framework for the utilization of greatest net long-term benefit for agriculture and other community interests.

b) The project stresses the need for utilizing existing water resources to the maximum before new sources are developed.

c) The plan maximizes beneficial uses, the main ingredient of the appropriation doctrine. Also, it utilizes optimum allocation techniques and process for water conservation.

d) The plan enhances in-stream uses in the South Platte River, by meeting the zero discharge of pollutants goal of PL 92-500 ahead of the 1985 schedule.

I feel it is high time that the EPA saves time and money by concluding the EIS process as soon as possible and making a grant offer to the City of Northglenn.

Yours very truly,

Tom Ambalam

Tom Ambalam
Professional Engineer
8150 W. 81st Pl.
Arvada, CO 80005

DRCOG

Denver Regional
Council of
Governments

February 25, 1980

24186

Roger L. Williams
Regional Administrator
United States Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80295

Re: EIS/002-80, Northglenn Water Management Program

Dear Mr. Williams:

The Denver Regional Council of Governments has reviewed the above captioned proposal for its consistency with adopted regional plans, policies, and review criteria. This proposal relates to the Regional Growth and Development Plan (RGDP), which establishes policies to guide decisions affecting regional development, the Clean Water Plan (CWP), which provides the basis for the sizing, staging, location, and treatment levels of future wastewater facilities and the determination of institutional arrangements for wastewater planning and management, and the Regional Water Study.

1 The project proposed by Northglenn is intended to provide water and wastewater service to defined urban service areas which is consistent with the Regional Growth and Development Plan. According to regional policy: "Regional systems and the full range of urban service should be provied only within Urban Service Areas; local or community services should be provided in Mountain Development areas and Rural Town Centers, and only limited county and rural services should be provided in non-urban areas."

The project is consistent with the Clean Water Plan. The principal of agricultural reuse of wastewater embodied by the Northglenn project is encouraged by DRCOG's Clean Water Plan and the Regional Water Study. The Northglenn project proposal was in the formative stages at the same time that the 208 plan was being developed, thus it was not included in the plan as it was originally adopted by DRCOG. The plan has been amended, however, to designate Northglenn as a Management Agency to carry out this project.

The project is consistent with these regional plans and should be recognized as an innovative approach towards solving both the problems of improving water quality and developing alternative water supply sources within the Denver Metropolitan Region. DRCOG urges quick and favorable action on the recommendation contained in the EIS.

If you have any question, please contact our review coordinator, Linda Nuzum.

Sincerely,

for Robert D. Farley
Executive Director

RDF/bjs
cc: The Hon. Fred Tapia, Councilman, Northglenn COG Representative

Council Officers

orig: BW
cy: RA, DRA, MO, RC

RESPONSE:

1. EPA recognizes that the project is consistent with the Denver Regional Council of Governments Clean Water Plan. The designation of Northglenn as a management agency within the DRCOG area, however, does not resolve the question of sharing the management responsibility with Weld County.

City Hall
City of Thornton

8992 N. Washington Street
Thornton, Colorado 80229
303/289-580

24184

February 25, 1980

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FEB 26 1980
EPA REGI[illegible]
Water Division

Mr. Roger L. Williams,
Regional Administrator
U. S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Dear Mr. Williams:

As part of the public comment process, the Thornton Utilities Board and City Council recently sent you a letter regarding their impressions of the Northglenn Environmental Impact Statement for the proposed water management program. The Utilities Board directed staff to further study the document and offer comments on the facts presented. Herewith follow the Utilities Department staff comments:

1 A. Page 3 refers to Thornton's water supply as having had concentrations of nitrite that exceed the National Drinking Water Standard. We would like to note that the nitrite problem in the distribution system occurred in 1977, after Northglenn began planning its own utilities system. Additionally, there is not a National Drinking Water Standard for nitrite. This non-existent Standard is also referred to on page 15.

2 B. Page 15 refers to 10,000 connections to the water and sewer system in the City of Northglenn. Our records show a total of 7,777 connections (7,434 residential; 315 commercial; and 28 multi-family).

3 C. Page 30. A paragraph on this page refers to injury to owners of mutual ditch company shares that might result with the implementation of the Northglenn Augmentation Plan. Thornton has filed its objections to this plan in water court.

orig: BW
cy: RA, DRA, NO, SRC

The City of Planned Progress

RESPONSE:

1. EPA recognizes Thornton has corrected its problem regarding nitrite and nitrate contamination. While there is no nitrite standard within the National Interim Primary Drinking Water Standards, there is a recommendation that nitrite concentrations not exceed 1 milligram per liter.

2. The reference to 10,000 connections within the City of Northglenn was provided by Northglenn's consultants. EPA acknowledges that your records indicate 7,777 connections as of this date.

3. EPA acknowledges that Thornton is an objector in the Water Court.

4	D. Page 30 states that Thornton receives all of its water from the South Platte Tributary well field. Thornton has historically diverted substantial amounts of water from Upper Clear Creek Ditches which are the main supply for our Thornton and Western Hills Water Treatment Plants. We have recently began developing water rights on Lower Clear Creek ditches and direct flow rights on the South Platte River. Presently, the wells make up approximately one-third of Thornton's total water supply, although at certain times of the year, almost 100 percent of the water in the treatment system comes from the wells. This supply is being evaluated as part of an ongoing study of South Platte River alternatives by CH_2M Hill.	4. EPA understands that the present source of Thornton's water supply includes contributions from both upper Clear Creek ditches and South Platte tributary wells.
5	E. Page 30 also refers to the 885 acre-feet per year of replacement water. Enclosed is a page copied from Volume II of the Severance Analysis completed by URS Company. This report indicates that 228 acre-feet will actually be required for replacement water.	5. Northglenn's 885 acre-feet of replacement water was developed by their consultants. If the 885 acre-feet of replacement water as stated, is not totally available additional replacement water will be required from the stormwater runoff-Grange Hall Creek or the tributary well field. If either of the alternative sources of replacement water are utilized then the water must be augmented.
6	F. Page 45. The first paragraph states that one objective of the Northglenn water management program is to guarantee an adequate water supply for Northglenn's future population. As was previously stated in the letter sent to you by the Utilities Board and City Council, Thornton's service presently is adequate and will be for all future residents of Northglenn. G. Page 51. Benefit 1 refers to improved water supply. Once again, our service is adequate and meets all State and Federal requirements.	6. See previous response to Thornton's letter dated January 31, 1980, with respect to Thornton's ability to supply Northglenn with adequate water supply in the future. Also see Thornton's letter of May 1, 1980, regarding their desire not to analyze the alternative of providing water to Northglenn at this time.
7	H. Page 82. The first paragraph states that the City of Thornton is to pay the Farmer's Reservoir and Irrigation Company the sum of $3,000,000 to line the Bull Canal system and laterals. Thornton, over a ten-year period, will pay FRICO over $16,000,000 for storage. FRICO has chosen to utilize some of these funds for the previously-mentioned lining project. Thornton is not in any	7. EPA recognizes that Thornton is not directly involved in the lining project nor is the City of Northglenn. The lining of the Bull Canal by the Farmers Reservoir and Irrigation Company is an independent, private action.

7 manner directly involved in any lining project at this time.

8 I. The Four-Way Agreement, beginning on page 181, is not the final version negotiated with FRICO. There are several minor changes in paragraph 26. Enclosed is a copy of the final revised agreement.

8. Acknowledge.

Sincerely,

Cary R. Palmer

Cary R. Palmer, P.E.
Utilities Director

CRP/WEK:ac

Enclosures
(Copy of 4 Way Agreement)

CITY OF NORTHGLENN
10701 Melody Dr., Suite 313
Northglenn, Colorado 80234
Phone (303) 451-8326

February 25, 1980

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RECEIVED
FEB 26 1980
EPA REGION VIII
Water Division

Mr. Weston Wilson
Environmental Evaluation Branch
U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, CO 80295

Re: City of Northglenn Comments on Draft Environmental Impact Statement On The Northglenn Wastewater Treatment Facilities Plan (EPA-908/5-79-002A)

Dear Mr. Wilson:

We have reviewed the Draft Environmental Impact Statement ("DEIS") and provide the following comments and recommendations, which, together with the City's comments on the Preliminary Environmental Report (Attachment C), we request be made part of the record of public review on the DEIS.

We agree with the fundamental conclusions of the DEIS, in which the Northglenn Facilities Plan is found to have environmental benefits that outweigh all possible negative effects and is found to be eligible for a construction grant under Title II of the Clean Water Act. We do have, however, the following specific comments on the DEIS:

1. Scope of EPA's Consideration of Alternatives: pp. 5, 45-87

1 The DEIS contains a detailed discussion of various alternatives available to the City to provide its citizens with a source of municipal water supply. At the public hearing on the DEIS, a number of commenters criticized EPA for not considering an even broader range of water supply alternatives.

The City has applied to EPA for a construction grant to assist in the construction of a sewage treatment facility using agricultural reuse of the effluent in lieu of discharge to waters of the United States. In preparing an EIS on the Northglenn grant application, EPA's NEPA regulations in 40 C.F.R. Part 6 provide for evaluation of the reasonable alternatives to the proposal for which the grant assistance is sought -- namely, a sewage treatment facility.

RESPONSE:

1. The National Environmental Policy Act requires that all federal agencies evaluate alternatives available within its federal jurisdiction as well as alternatives beyond its jurisdiction. Since the wastewater treatment facilities to be constructed by the City of Northglenn are part of a water supply system, EPA determined that it was necessary, in order to comply with NEPA regulations, to fully evaluate those alternatives for both a water supply system and a wastewater treatment system. Further, the mechanism for funding Northglenn's proposed wastewater treatment system is defined by the multi-purpose cost-effective analysis which requires analyzing both wastewater and agricultural reuse elements. Northglenn's proposal includes both wastewater treatment and agricultural reuse, therefore, it is dependent upon EPA to consider alternatives for both such actions.

It is beyond the scope of EPA's review under NEPA for EPA to consider alternatives to the City's plan to supply water to its citizens, in the context of an application for a sewage treatment construction grant. EPA's regulations in 40 C.F.R. Section 6.507(c)(5)(i)-(viii) list the categories of alternatives that are to be evaluated in the environmental review of a facilities plan. Nowhere do the regulations provide for the consideration of water supply alternatives.

1

The fact that the City has had the foresight to coordinate its water supply, water treatment, and wastewater treatment and disposal functions by means of a comprehensive plan has absolutely no bearing on the scope of EPA's environmental review under NEPA. NEPA requires that agencies consider the environmental effects of their proposed actions and of alternatives to their proposed actions -- it does not require nor authorize the agency to condition a Section 201(j) construction grant on an analysis of a city's water supply plan. It does not require the agency to evaluate projects and their alternatives, which are funded entirely through local funds. See Friends of the Earth v. Coleman, 518 F. 2d 323, 8 ERC 1617 (9th Cir. 1975). To do so is an unwarranted intrusion into local decision-making and is unreasonably burdensome to applicants seeking to implement the agricultural reuse goals of the Clean Water Act.

To require cities seeking construction grant funds for agricultural reuse to provide a comprehensive analysis of all water supply alternatives available to them -- in addition to the normal information required for the grant application -- is to sound the death knoll for agricultural exchange and reuse in the western states. The costs of obtaining the grant will simply outweigh the benefits of the grant. This is a direct contravention of Congress' intent to promote agricultural reuse of wastewater expressed in Sections 201(g), 201(j) and 304(d)(3) of the Clean Water Act.

The City has attempted to provide EPA with all requested information concerning every aspect of its comprehensive water management plan. It has done this in order to keep EPA informed about the entire Northglenn water management plan. The City will continue to provide to EPA whatever information is within its control, but Northglenn vigorously objects to the expansion of EPA's environmental review to include consideration of the City's water supply alternatives in the environmental impact statement.

Mr. Weston Wilson
February 25, 1980
Page three

2. Need for the Wastewater Treatment Facility: pp. 15-16

2 EPA states in the draft that the need for the City's wastewater treatment facility is "in effect. . . entirely a function of the water supply and exchange program". This statement is incorrect and reflects a basic misunderstanding of the City's water management plan and the City's role as a home rule city and wastewater management agency.

The type of treatment system chosen by the City is, to an extent, a function of the method selected to provide the City with a reliable and economical water supply -- water sharing with the FRICO farmers. To make the water sharing arrangement functional, the City has designed the wastewater treatment facility to be complementary to the exchange. It has been designed to allow the City to perform its obligations under the exchange agreement with FRICO.

The need for a wastewater treatment facility to treat wastes generated in the Northglenn service area, however, is not a function of the water supply arrangement. Northglenn is a home rule city under the Colorado Constitution, and is a designated wastewater management agency under the Denver Regional Council of Governments Section 208 water quality management plan. As such, it is responsible for providing wastewater treatment to its citizens under both state municipal law and the federal/state water quality management program under the Clean Water Act.

Prior to its designation as a wastewater management agency and its severance from the City of Thornton utilities system, the responsibility for treatment of the Northglenn wastewater was left to the City of Thornton. Thornton, in turn, is a member of the Metro Denver district and thus entitled to send its wastewater to Metro Denver. Upon designation as the wastewater management agency for its area, Northglenn has proceeded to perform its responsibilities by severing from the Thornton utilities system. Northglenn is not a member of the Metro Denver district.

The need for wastewater treatment is a function of the generation of 4.6 MGD of wastewater by the City of Northglenn inhabitants. The only question is the type of treatment system to be used -- a decision for which Northglenn as the management agency has been delegated responsibility. Northglenn has determined that the proposed wastewater treatment facility in Weld County is the most efficient alternative - from both an economic and environmental standpoint. This

RESPONSE:

2. While the impact statement does say that the need for the facility is entirely the function of the water supply system, EPA recognizes that the type of treatment system chosen by the City is a function of the need to exchange water with the Farmers Reservoir and Irrigation Company. Additionally, the need for the facility is, as Northglenn indicates, based on the need to treat wastewaters. Northglenn's grant eligibility under the EPA-administered Wastewater Construction Grants Program is a function of the costs associated with treating the wastewater generated within the community. The grant determination for the proposal, as previously mentioned, is a function of that need.

determination was made after consideration of a number of factors and alternatives -- including the costs of seeking membership in the Metro Denver system. Subsequent to approval by DRCOG and the Governor, Northglenn's decision was approved by the State Water Quality Control Commission in April 3, 1979 when the Commission found that the facility was needed and the proposed site appropriate.

2 In short, the need for the Northglenn wastewater treatment facility is a function of the wastewater treatment needs of the Northglenn citizens -- not the water supply needs of the City. As reason would dictate, the wastewater treatment facility has been designed to be complementary with the water supply method chosen by the City -- but it is not merely a creature of the water exchange arrangement.

We suggest, therefore, that the last paragraph on page 16 of the DEIS be revised to read:

> Northglenn's wastewater treatment need is a function of its responsibilities as a home rule city and a wastewater management agency under the DRCOG Section 208 plan to provide treatment for 4.6 MGD of wastewater generated within its management area. The proposed treatment facility is designed to meet this need while at the same time making possible the Northglenn water exchange agreement with the FRICO farmers.

3. Description of the Northglenn Plan: p. 3

Although the City of Thornton is currently providing a water supply and wastewater treatment to Northglenn, its contractual obligation to continue this service expires on November 1, 1983 under the terms of the Northglenn/Thornton Severance Agreement (May, 1979). The "status quo" alternative, therefore, is not simply continued utilities service from Thornton -- since there is no agreement to provide service beyond November 1, 1983. The "status quo" alternative is no wastewater treatment or water supply after November 1, 1983. An alternative to the proposed Northglenn wastewater treatment facility is for Northglenn to attempt to negotiate a long term service contract with Thornton to provide wastewater treatment via Metro Denver. An alternative to the Northglenn water supply agreement with FRICO is to attempt to negotiate a water supply contract with Thornton for a reliable source of supply. These are not, however, "status quo" alternatives. 3

3. EPA recognizes that even without a federal grant Northglenn would likely construct these facilities at its expense. Failure to implement the FRICO exchange agreement would require a change in the severance agreement with the City of Thornton.

Mr. Weston Wilson
February 25, 1980
Page five

4. Treatment of Northglenn Wastewater at Metro Denver: p. 4

4 Paragraph 3 on page 4 of the DEIS states that Northglenn wastewater presently is conveyed by Thornton to Metro Denver for treatment. While this statement is correct, it is misleading. As discussed above, Northglenn is not a member of the Metro District and has been prevented in the past from participating in elections for the approval of financing improvements at the Metro Denver Central Plant. Northglenn is provided service at Metro Denver only because it has a short term service contract with Thornton, which will expire in 1983. It is also necessary, commencing immediately, for Metro Denver to expand and upgrade its service if it is to provide service to Northglenn and other customers in the future. These facts should be made clear early in the DEIS so that the public will not be mislead concerning the status quo of wastewater services for the City of Northglenn. We have submitted to EPA detailed documentation concerning the Metro Denver alternative, and are prepared to provide further information if requested.

We suggest, therefore, that paragraph 3 on page 4 be revised as follows:

> Presently Northglenn's wastewater is conveyed by the Thornton system and treated at the Denver Metropolitan Sewer District No. 1 (Denver Metro). Northglenn's service contract with Thornton for this wastewater treatment, however, will expire in 1983. Northglenn is not presently a member of the Metro Disrict. Consequently, Northglenn has submitted a facilities plan to EPA to treat its own wastewater. Northglenn's revised facility plan makes the following recommendations for wastewater transport, treatment, and disposal:

5. Description of the Water Supply Options: p. 5

5 As discussed above, Northglenn objects to the consideration of alternative water supply options as part of EPA's NEPA review of Northglenn's wastewater treatment facilities plan. For the sake of accuracy, however, Northglenn would like to comment on the DEIS list of water supply options on page 5. Since the mid 1970s, Northglenn has studied a wide range of water supply as

4. EPA acknowledges that Northglenn's service contract with Thornton for its wastewater treatment will expire in 1983. Northglenn presently receives wastewater treatment by the Denver Metro District by way of contract with the City of Thornton. However, Northglenn is not a member of the Denver Metro District.

5. The water supply alternative section has been revised to include a cost and impact analysis of several water supply options available to the City of Northglenn. See water supply alternative section in Chapter 3. In addition the alternative site analysis has been expanded which considers three optional sites south of Northglenn's proposed site.

well as wastewater treatment options. While the DEIS identifies four of the water supply options, we would like the record to show that Northglenn, in fact, considered an even wider range of options. The water supply options included:

(1) Long-term Thornton Service Contract
(2) Denver Water Board
(3) New Transmountain Diversions
(4) I76 Well Field
(5) Non-tributary Wells
(6) Boxelder Creek Agricultural Reuse
(7) Colorado Big Thompson Project
(8) Condemnation or Purchase East Slope Agricultural Supplies
(9) FRICO Agricultural Reuse

5 A number of these water supply options were rejected after a threshold determination that they would be too costly -- from either or both economic and environmental standpoints. Others were analyzed in greater detail and rejected on the same grounds.

Northglenn also considered a wide range of alternative wastewater treatment options. These included:

(1) 13 Options for Treatment at Metro Denver Central Plant (Lower South Platte Facility Plan)

(2) 8 Options for Agricultural Reuse with FRICO (Lower South Platte Facility Plan and Northglenn Agricultural Reuse Facility Plan)

(3) 4 Options for Agricultural Reuse in the Boulder Creek Basin

(4) 10 Alternative Sites for Implementation of FRICO Agricultural Reuse

Northglenn has provided EPA with data on alternative treatment system options as part of the City's facilities plan.

6. Proposed EPA Decision, Grant Amount: p. 6

Northglenn submitted to EPA on December 7, 1979 its comments on the calculation of the $6,948,000 grant amount. In addition to technical errors by EPA in its calculation of the grant amount, Northglenn wishes to be on record in its disagreement with EPA on the application of the cost effectiveness regulations in regard to EPA's definition of the "least cost pollution control alternative."

The costs of treatment at Metro Denver are substantially underestimated for one or more of the following reasons:

6a (a) Although the present discharge permit may be consistent with the wasteload allocations of the South Platte River 303(e) Plan, the Plan has expired and was replaced by the current 208 Plan. This predetermined expiration was actually included as a part of the original resolution of adoption of the 303(e) Plan. The 208 Plan sets forth a wasteload allocation which is substantially more stringent in order to meet the existing stream classification. Therefore, it is incorrect to suggest that the current discharge permit will meet existing stream quality standards and that the South Platte must first be reclassified to require a more stringent standard for Metro Denver. In other words, the existing classification requires a substantially higher level of treatment than the discharge permit requires.

6b (b) The capital costs for sludge disposal at the Metro Denver Central Plant have been excluded. The justification under the regulations for this exclusion is not in the DEIS.

6c (c) The costs to meet the current discharge permit requirements appear to be much too low. The cost estimates prepared by Metro Denver and its consultant Culp, Wesner and Culp should be factored into the analysis.

The City believes these facts should be carefully considered before EPA makes its final decision relative to the grant amount. We stand ready to further elaborate on these comments and provide supplemental information to the technical documents previously submitted on these issues.

7. Prevention of Agricultural Tailwater Runoff Into Towns of Frederick and Firestone; Prevention of Sale of Raw Edible Crops Grown Under Standley Lake Division of FRICO: p. 7

7 We do not believe that the application of items 2 and 4 as grant conditions are supportable under either the Colorado stream classification system or the technical analyses of the DEIS. Although we recognize that EPA regulations and guidelines may be non-conclusive in this area, we do not believe it is a prudent course of action to apply an arbitrary standard to the Northglenn plan. Rather, EPA and the Colorado Department of Health should follow a carefully planned procedure for the development of a definable standard. The first step in this process should

6a. The Denver Regional Council of Governments 208 Clean Water Plan makes recommendations for the ultimate classification of the South Platte River. The cost estimates for Northglenn's pro-rated share of the Denver Metro treatment system costs are based on the existing water quality standards for the South Platte. EPA determined that it could not make a cost allocation based on speculation of a future decision by the State Water Quality Control Commission relative to water quality standards.

6b. The justification under the regulations for not including the costs of sludge disposal of the Metro Denver Central Plant is that the facilities are not sized differently with the elimination of Northglenn's proportional input to that system. As a consequence of the facility size remaining the same no difference in cost allowance or sludge disposal in Denver Metro is allowed.

6c. Revisions to the cost estimates for the Denver Metro facility plan have been prepared by Culp Wesner and Culp. It is EPA's procedure that once a determination is made of the percentage eligibility under a multipurpose cost analysis that percentage remains fixed for the remainder of the project. This procedure is necessary because cost estimates are continually updated and EPA would be forced to make continuous revisions to the grant eligible amount if they did not use the initial cost estimate. As a consequence, the revised Denver Metro facility plan costs will not be included in this cost analysis.

7. The potential exists that waterborne disease could be transmitted from this facility. EPA maintains it is prudent and reasonable to require the 200/100 ml fecal coliform effluent limit to reduce the relative health risks. Therefore, EPA will require this standard within the NPDES permit. There may be an apparent successful history of irrigation of raw edible food crops downstream of the Denver Metro Sewage Treatment Plan, but this is not a demonstrable fact. It has not been demonstrated by independent analysis that waterborne diseases are not transmitted to crops irrigated with Denver Metro effluent. EPA has determined it will not be necessary for the City of Northglenn to impose a ban on raw edible food crops, but will require Northglenn to advise farmers not to grow raw edible food crops with this effluent.

7 include a well-designed program for the collection and interpretation of data. There is a long and successful history of irrigation of raw edible food crops in the South Platte Valley downstream of several Denver area sewage treatment plants. This history should be examined and, if necessary, supplemented by additional data prior to the establishment of any new standards. In the interim, the same standard which applies to the other Denver area sewage treatment plants should be applied to the Northglenn facility. If, as a result of new information, a new standard is established, it can then be uniformly applied to all discharges to irrigation ditches. We have attached a Feburary 5, 1980 (Attachment A) technical memorandum by Sheaffer and Roland which further elaborates on this point of view. Northglenn stands ready to cooperate with EPA in its efforts to resolve this matter.

8. Potential Odor Problems: pp. 6, 67-72

8 Paragraph 4 on page 6 appears to conclude that a "potential odor problem at the treatment site" will be a significant direct adverse environmental effect of the Northglenn facilities plan. On pages 67 - 72, the DEIS contains a detailed analysis of the possible areas which may be affected by an "odor episode" at the wastewater treatment lagoons. The DEIS, however, does not discuss the unlikely chain of events necessary to create an odor episode nor does it point out the design features of the plan which mitigate the possibility of occurrence of an "odor episode." We believe it would be appropriate for EPA to include this discussion in the Final EIS and it should include a comparison with the design features of other aerated lagoons in the area so that the public will be more fully informed. We have attached a Feburary 11, 1980 technical memorandum by Sheaffer and Roland on this subject for your consideration (Attachment B).

9. Effect On Adjacent Land Values: p. 9

9 The City agrees with EPA's assessment that the long term decrease in adjacent land values are insignificant. This conclusion is supported by experience with other similar systems. We have attached for your information a technical analysis of the effect on land values of a much larger set of treatment lagoons and storage reservoirs in Muskegon County, Michigan as further support for the conclusions of the DEIS.

10. Bull Canal As Source of Water Supply For The Town Of Frederick: pp. 10, 39-41

10 Northglenn agrees with EPA's conclusion that it is not obliged to insure that the Bull Canal be a source of future water supply for the Town of Frederick. It should be emphasized that Frederick

8. An analysis of Northglenn's proposed wastewater treatment plant and associated storage reservoir has been conducted and included as part of the final EIS. It is recognized that it is difficult to find the chain of events necessary to create an odor episode and to provide mitigation measures for any individual episode. EPA believes there is a likelihood of an odor event occurring as a consequence of Northglenn's facilities inability to consistently meet the proposed suspended solids discharge requirement. The circumstances surrounding such an event would be associated with a large algal bloom in the reservoir that could generate odors during the decay process. Additionally, suspended solids could carry over into the Bull Canal and decay during transport downstream generating additional odor. The actual odor event itself and its frequency cannot be determined and mitigation measures to control algal production within the reservoir will in effect be mitigation measures for odor episodes.

9. EPA acknowledges that in other systems the decrease in adjacent land values has been different. Those changes in value are largely a result of public perception and acceptance of the facility.

10. Refer to response to the City of Frederick, City of Fort Lupton, Weld County and Larimer-Weld-Cog relative to the classification of the Bull Canal as a domestic water supply source.

10 has merely indicated a desire to use the Bull Canal as a water supply - it has not offered any specific plans for doing so.

Frederick currently does not even own any shares in the Bull Canal, and the shares which it claims may become available in the future are under condemnation by Thornton. We understand that the owner of these shares is currently negotiating the removal of this condemnation by selling these same shares and its remaining shares in FRICO to the City of Thornton. Other sources are available to Frederick and it should continue to pursue those sources.

Frederick should recognize that one of the reasons FRICO entered into a reuse agreement in the first place was to prevent future speculation on the use of the Bull Canal as a municipal water supply conduit. Such a use would be in direct conflict with the optimum use of the canal for its intended purposes as an irrigation canal. Northglenn appreciates EPA's support of FRICO's efforts as a part of its policy to protect and enhance agriculture in the Front Range.

11. Thornton Water Service: p. 15

11 Contrary to Thornton's bare assertion that it can provide adequate water services to Northglenn, the problems with the quality and quantity of water supplies available to Thornton are well-documented in published reports by the City of Thornton, the Colorado Legislature and the Denver Regional Council of Governments. See Water Discussion and Treatment Reconnaisance Study, for the City of Thornton, Colorado CH2M Hill (June, 1978); Metropolitan Water Requirements and Resources, 1975-2010, prepared for Colorado State Legislature, Metropolitan Denver Water Study Committee (January, 1975); Regional Water Study, Denver Regional Council of Governments (April, 1978). Thornton contends that these problems have either been solved or did not exist in the first place, without any documentation for their contention. Thornton's assertion must be supported by documentation if it is to be given credence in the Final Environmental Impact Statement.

12. Agricultural Issues -- Effect of Nutrients: p. 26

12 The final EIS should make reference to the technical memoranda, dated August 14 and August 29, 1979, that Northglenn has submitted to EPA on the subject of the wastewater nitrogen and its impact on crops grown under FRICO. These memoranda provide conclusive evidence that the Northglenn plan for agricultural reuse of its wastewater reflects good nutrient management practices and conforms, for example, with the Larimer/Weld Regional Council of Governments Section 208 Plan for control of agricultural non-point sources pollution.

11. EPA has revised its water supply alternative section to include the option of Thornton continuing to provide Northglenn's water supply

12. See response to comments by the Great Western Sugar Company and Larimer-Weld Regional Council of Government with respect to these effects upon agricultural productivity.

12 Great Western Sugar Company testified at the February 13, 1980 public hearing that Northglenn's plan posed no threat to efficient sugar beet production. Northglenn intends to work closely with Great Western in developing the City's Agricultural Reuse Manual to assure that irrigation practices maximize the effective use of the reuse irrigation in sugar beet and other crop cultivation.

13. Tributary Ground Water: p. 27

13 Northglenn concurs with the conclusion that the tributary well fields will have no adverse effect on agricultural lands. The statement in the DEIS, however, that "final evaluation of the impacts of the well field cannot be completed until the field is located and the wells are designed" is misleading. It suggests that no analysis of the environmental effects of the well field has been performed. This is simply incorrect.

It is true that Northglenn has not yet finally located the well field. Northglenn, however, has selected a group of alternative sites for the wells and has analyzed the environmental effects of each. Northglenn has provided EPA with this information, and is prepared to elaborate on that information if necessary.

14. Lining of Bull Canal: p. 28

14 The discussion on the Bull Canal lining appears to imply that the lining is still in the planning stage and may or may not be completed. FRICO began lining the Bull Canal in the Fall of 1979 and as of this date the lining is 30 to 40 percent complete. This project is being undertaken solely under the supervision and control of the FRICO Board as a part of its responsibility to the FRICO shareholders. Northglenn supports FRICO in this effort as an environmentally sound approach to make more efficient use of available water supplies of the Front Range.

15. Legal Issues: p. 33

15 The DEIS states that "even though FRICO may legally be able to line the Bull Canal, this action could adversely impact downstream users that have historically depended on seepage water from the canal."

This statement is misleading because it implies that irrigation return flows will be diminished under the FRICO system as a result of the Northglenn reuse arrangement. With the possible exception of the Firestone/Frederick tailwater control plan, this is not

13. Subsequent to the distribution of the draft EIS Northglenn has determined the final location of its tributary well field. Utilization of the tributary groundwater will be determined by the water Court.

14. EPA recognizes the lining of the Bull Canal is an independent action of the FRICO Board.

15. EPA's independent review indicates that there may be some reduction in return flows as a result of this canal lining.

15 the case. The return flows should increase slightly due to the 10% bonus on the water borrowed by Northglenn.

Sincerely yours,

Richard P. Lundahl
Director of the Department of
Natural Resources
City of Northglenn, Colorado

cc: Robert McGregor
William T. Smith, Jr.

LARIMER - WELD REGIONAL COUNCIL OF GOVERNMENTS
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February 25, 1980

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RECEIVED
FEB 28 1980
EPA REGION VIII
Water Division

Mr. Roger Williams
Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, CO 80295

Dear Mr. Williams:

Re: Draft Environmental Impact Statement - Northglenn Water Management Program, City of Northglenn, Colorado

The Larimer-Weld Regional Council of Governments, a designated Water Quality Management Planning Agency under Section 208 of the Federal Clean Water Act as amended, has completed a review of the Draft Environmental Impact Statement for the proposed Northglenn Water Management Program.

1 We believe EPA's decision to prepare an Environmental Impact Statement on this project was a prudent choice, as this is the first time that various parts of the Northglenn proposal have been identified in sufficient detail to permit a thorough review of the sizing, location and financing of the project as well as an evaluation of implications of the operation of its various components. However, we are concerned that the procedural requirements of the National Environmental Policy Act and recently promulgated regulations thereunder may have been violated.

In previous communications with the United States Environmental Protection Agency and the State of Colorado, the LWRCOG has not formally taken a position in support of or in opposition to the Northglenn Water Management Program. We have merely requested that sufficient information be provided for all affected parties to begin a thorough and accurate evaluation of the environmental impacts of the proposed program.

Based upon the comments which were received by EPA at the Public Hearing held in the City of Northglenn on 13 February 1980, there are still major unresolved concerns regarding the proposal. Among these are the actual need for the project; the advisability of providing federal Construction Grant Program assistance for wastewater collection and treatment portions of the project; issuance of a NPDES permit; and management of the proposed treatment facilities in accordance with applicable 208 Areawide Water Quality Management Plans.

2 The Larimer-Weld Regional Council of Governments, through its 208 Areawide Water Quality Planning Committee, which is a policy and technical advisory committee to the Larimer-Weld Regional Council of Governments' Governing Board, has examined these issues in detail to determine their effects upon the locally

orig: BW
cy: RA, DRA, MO, RC

RESPONSE:

1. EPA wishes to acknowledge the interest that the Larimer-Weld Regional Council of Governments has taken in the preparation of the Environmental Impact Statement on the Northglenn Water Resource Management Program. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

2. EPA acknowledges the various items of interest the Larimer-Weld Regional Council of Governments has indicated as areas of concern. Each of the nine issues identified will be responded to below.

adopted, state-certified and EPA-approved Water Quality Management Plan for Larimer and Weld Counties, Colorado. In addition, the 208 Areawide Planning Committee has viewed the project in its broader perspective as a project which will set precedents in water quality related water resource policy along Colorado's Front Range. The issues which we have examined and request EPA to respond to include the following:

1. Need for the Project
2. Applicability of EPA "Multiple Use" Classification of Northglenn Proposal
3. Applicability of "Alternative Technology" Classification of Northglenn Proposal
4. EPA Adherence to Revised Work Plan for Preparation of Environmental Assessment
5. EPA Compliance with NEPA Regulations Covering Preparation of Environmental Impact Statements
6. Recommended Stream Classification for Bull Canal
7. Requirements for Environmental Impact Statement on NPDES Permit
8. Management Agency Designation
9. Conditions for EPA Grant Approval, IGA and NPDES Permit

2

The attached narrative contains the LWRCOG 208 Areawide Planning Committee's detailed comments on EPA's Draft Environmental Impact Statement. We request that all of these comments and attachments be made part of the official hearing record.

We look forward to working with you in finding a cost effective and environmentally responsible solution to the City of Northglenn's water supply and waste treatment problems.

Sincerely yours,

Jonathan M. Rutstein
Jonathan M. Rutstein
Executive Director

JMR:sks
Enclosures

cc: The Honorable Gary Hart, U.S. Senator
Harris Sherman, Chairman Colorado Water Quality Control Commission
Paula Herzmark, Director, Department of Local Affairs
Gary Broetzman, Director, Water Quality Control Division
Morgan Smith, Commissioner of Agriculture

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Larimer-Weld Regional Council of Governments comment* on U.S Environmental Protection Agency Draft Environmental Impact Statement For Northglenn Water Management Program Northglenn, Colorado. (EPA 908/5-79-002A)

3

1. NEED FOR THE PROJECT

At page 16 of the Draft Statement, it is stated that, "Northglenn's wastewater treatment need is entirely a function of the water supply and exchange program. In order to implement the exchange, control of wastewater treatment and discharged is essential."

We are encouraged to see that EPA has formally recognized the fact that the City of Northglenn's need of federal financial assistance under Section 201 of the Federal Clean Water Act is solely to satisfy its water supply commitments, and is not directly related to an immediate need for the collection and treatment of waste waters generated by the City of Northglenn.

At page 15 of the Draft Statement, EPA states "Northglenn's stated position is that the City of Thornton cannot provide an acceptable water supply, either in terms of quantity or quality. The raw water quality of Thornton's Columbine Treatment Plant has on occasion had nitrite concentrations that exceed the drinking water standard of 1.0 ml. per liter ... the current position of Thornton is that they can provide an adequate water supply for themselves and Northglenn (3)."

Information provided by the City of Thornton at the U.S. Environmental Protection Agency Public Hearing held in Northglenn on February 13, 1980 refutes statements by the City of Northglenn regarding the quality of water and the ability of Thornton to provide an adequate domestic water supply now and into the future. A copy of these materials is provided as Attachment 1. It includes a letter dated January 31, 1980 from the City of Thornton Utilities Board to Mr. Roger L. Williams, Regional Administrator, U.S. Environmental Protection Agency, a resolution dated February 11, 1980 from the City of Thornton City Council

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*Supplemental comments to verbal testimony presented at public hearing in Northglenn February 13, 1980.

3. EPA references Larimer-Weld COG to the discussion on water supply alternatives in Chapter 3. The option of Thornton continuing to supply Northglenn with a water supply is presented in that Chapter.

3 supporting the Thornton Utilities Board's position on the Draft Environmental Impact Statement for the Northglenn Water Management Program, and a letter from the City of Thornton Utilities Board to the City of Nortnglenn expressing their desire to discuss alternative water supply options available to Northglenn.

4 The Larimer-Weld Regional Council of Governments believes that sufficient documentation has been provided to question the overall need for the project, and specifically the request by the City of Northglenn for federal construction grants funds under Section 201 of the Clean Water Act to support that endeavor. Further, we question the method by which the State of Colorado Water Quality Control Commission allocated priority points to this project which enabled the City of Northglenn to progress high enough on the Construction Grants Priority List to be eligible for funds from the State of Colorado federal allotment of Title II - Grants For Construction of Treatment Works. Attachment 2 is a letter dated June 4, 1979 to Mr. Harris Sherman, Chairman, Colorado Water Quality Control Commission, from the Board of Commissioners, Weld County, specifically challenging the allocation of points under the Colorado State Construction Grants Priority List system.

As stated under Section 201(d) of the Federal Clean Water Act as amended:

(d) The Administrator shall encourage waste treatment management which results in the construction of revenue producing facilities providing for --

  (1) The recycling of potential sewage pollutants through the production of agriculture, silviculture, or aquaculture products, or any combination thereof;

  (2) The confined and contained disposal of pollutants not recycled;

  (3) The reclamation of wastewater; and

  (4) The ultimate disposal of sludge in a manner that will not result in environmental hazards.

(e) The Administrator shall encourage waste treatment management which results in integrating facilities for sewage treatment and recycling with facilities to treat, dispose of, or utilize other industrial and municipal wastes, including but not limited to solid

4. The final EIS describes the need for the Northglenn wastewater treatment facility in Chapter 2 as being a function of its water supply system necessitated by the need to treat wastewater. Its eligibility under the Clean Water Act is based on the need for grant award to the community for treatment of its pro rata share of flows associated with Denver Metro facility. EPA recognizes the requirement of the Clean Water Act to encourage wastewater treatment systems which recycle and reclaim wastewater. In this regard the Northglenn facility accomplishes this function by providing a second purpose - agriculture reuse - which is beyond the necessary requirements to treat and discharge wastewater. EPA authority under 40 CFR 35.915 is limited to determining whether State projects listed for construction grants include only those projects as necessary to meet enforceable requirements of the act. The eligibility of the Northglenn proposal is based on its pro rata costs for expansion of the Denver Metro plant in order to meet present permit limitations. Grant eligibility for a community according to EPA cost-effective regulations is established on the basis of meeting such enforceable permit requirements. If this remains an issue, it can be discussed during EPA's EIS public hearing.

waste and waste heat and thermal discharges. Such integrated facilities shall be designed and operated to produce revenues in excess of capital and operation and maintenance costs and such revenues shall be used by the designated regional management agency to aid in financing other environmental improvement programs.

4

Nowhere to our knowledge, does the Act require or encourage the subsidization of municipal subdivisions to fulfill their manifest destiny desires for an independently owned municipal water supply and wastewater collection and treatment system where adeqaute service for existing and future sewer needs has been substantiated. We believe that the question of "need for the project" has been raised in sufficient detail to warrant a public hearing by the Regional Administrator of the Environmental Protection Agency for review of compliance with the Enforceable Requirements of the Federal Clean Water Act and Review for Eligibility as set forth under 40 CFR section 35.915 (g) and (h) - State Priority System and Project Priority List.

There are over 300 entities on the State of Colorado Construction Grants priority list, many of whom are in great need of federal assistance to plan for, design and construct legitimate waste treatment projects. Their respective needs for construction grant funds are directly related to bringing these communities into compliance with the enforceable requirements of the federal Clean Water Act. We believe their ability to do so is severely restricted by the State of Colorado and EPA's intent to award 6.948 million dollars to the City of Northglenn. We do not specifically challenge the point priority system of the State of Colorado which EPA has approved. We merely question the specific allocation of points to the City of Northglenn through that allocations procedure. We believe it is the duty of the Environmental Protection Agency to review such questionable actions and to ensure that federal tax dollars are expended for the purpose they were intended as authorized under the Federal Clean Water Act.

REQUESTED RESPONSE: We ask The Regional Administrator of EPA to hold a Public Hearing as set forth in 40 CFR 35.915 (g) and (h) to determine the eligibility of the proposed project for Title II - Construction Grant Program assistance, and to assess the procedure by which the State of Colorado allocated construction grants priority points to the City of Northglenn.

5

2. APPLICABILITY OF EPA "MULTIPLE USE" CLASSIFICATION OF NORTHGLENN PROPOSAL.

As defined in EPA's "Strategies For Funding of Multiple Use Projects" prepared by the Office of Water and Waste Management (U.S. EPA June, 1979),

> "A multiple use project addresses water pollution control and at least one other acceptable purpose. These latter purposes are in the language of the Clean Water Act,
>
> control of non-point sources of pollution;
> recycling of sewage pollutants;
> confined and contained disposal of unrecyclable pollutants;
> reclamation of wastewater;
> disposal of sludge;
> co-treatment and disposal of other municipal wastes;
> open space and recreation;
> reduced total energy requirements" (p. 1)

It is not apparent that the Northglenn proposal accomplishes any of the listed purposes to any greater extent than has been historically carried out in Colorado for the last 60 years. In a water short area of the United States such as Colorardo, recycling and reclamation of water occurs as a matter of necessity. In Northern Colorado approximately 25 municipal facilities discharge their treated wastes to ditches or natural waterways which are then used immediately for agricultural use, whereby the nutrient - pollutants are made available for crop production. Water and nutrient recycling and reclamation are simply not new in the context of Colorado water usage. They are a matter of beneficial coexistence between municipal discharges and agriculture.

If EPA choses to fund Northglenn's proposal as a "multiple use" project nearly all of Colorado's Wastewater Projects which discharge to a ditch or heavily used (and appropriated) natural waterway in agricultural areas should qualify.

EPA's Multiple Use Strategy says nothing in support of subsidizing water supply projects. Yet EPA has, as we have mentioned previously, admitted that Northglenn's waste treatment need is entirely a function of its water supply commitments.

5. EPA strategies for funding multiple-use projects contains a list of multiple-purpose projects which are considered alternative technology by virtue of controlling nonpoint sources of pollution and recycling and reclaiming wastewaters. Northglenn meets this purpose by guaranteeing that its effluent disposal will be used in agriculture. This differs from "de facto" reuse or historical reuse of sewage effluent by virtue of its guarantee. Northglenn's ability to store wastewater, to augment borrowed water, and to discharge only upon irrigators demand clearly makes it an agricultural reuse system. Further, the City of Northglenn has agreed to an EPA requirement to maintain control of sufficient land such that if there is insufficient demand by private irrigators the wastewater will be reused for agriculture. EPA does not believe that nearly all of Colorado's wastewater projects would be eligible for multi-purpose project funding because they fail to have this commitment to agriculture. Each new project will be considered in the future on a case-by-case basis of whether or not it can meet the seven items for commitment to these purposes. If new projects can meet these requirements they will be eligible for multiple purpose funding as is the Northglenn facility.

EPA states at page 61 of the Draft Statement that:

> "For EPA to participate in the funding of a Multiple Use Project, the following should apply:
>
> 1. The cost of multiple-purpose project must not exceed the sum of the costs of the most cost-effective single-purpose options which accomplish the same purposes.
> 2. The primary and secondary environmental effects must be assessed in accordance with the NEPA review procedures, and the project must not have any significant net adverse environmental effects.
> 3. At least one of the purposes must be necessary to meet an enforceable requirement of the Act.
> 4. There is no purchase of existing facilities with federal funds.
> 5. The project meets the definition of treatment works, and the works are publicly owned.
> 6. The project is consistent with the adopted and approved water quality management plan.
> 7. For agricultural reuse projects a commitment to this use for the design life of the project is necessary.

5

Northglenn meets all of these requirements (see Chapter 1 - EPA decision.)"

While EPA may have concluded that the written policies of the administrative document prepared for funding multiple use projects has been satisfied, we do not see that there is sufficient common sense justification to fund the project.

We find that EPA's criteria to fund the proposal under a multiple use strategy is somewhat confusing in its priorities to protect or enhance the quality of aquatic life in the South Platte River while increasing the public health risk to water users in the Bull Canal system. EPA's apparent concern about public health and water use is manifested in its request for very stringent requirements to be included as grant conditions, NPDES permit requirements or elements of 208 Intergovernmental agreements.

REQUESTED RESPONSE: We request that EPA justify its decision to fund the project in the context of its Multiple Use Strategy and the Federal Clean Water Act as they would apply in the State of Colorado.

6

3. APPLICABILITY OF "ALTERNATIVE TECHNOLOGY" CLASSIFICATION OF NORTHGLENN PROJECT

A. The Northglenn proposal is simply a conventional secondary treatment and storage system which discharges to a man-made canal where water is used primarily for irrigation. In addition, several communities in the Bull Canal system have made or are making substantial investments in water supply systems to use water in the canal for domestic water supply purposes. There is nothing alternative about the Northglenn wastewater system. It has never been designed to accomplish a purpose of land treatment or reuse. Therefore it should not be eligible for 85% funding of construction costs.

B. If by any sense of imagination this proposal could be classified as "alternative", the present method of waste treatment for Northglenn's waste will not be abandoned. The capacity at Denver Metro Sewage Disposal District facilities will merely be made available to serve other future population growth in the Denver area. In essence, the discharge equivalent from Northglenn will be replaced by some other Denver Metro customer.

REQUESTED RESPONSE: We request that EPA and the State of Colorado specifically identify the components of the Northglenn proposal which would classify it as an "alternative techology" system eligible for special funding consideration. Please cite all federal regulations and agency policy guideline materials used in making this determination.

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4. EPA ADHERENCE TO REVISED WORK PLAN FOR PREPARATION OF ENVIRONMENTAL ASSESSMENT

On April 3, 1979, at a regular meeting of the Colorado Water Quality Control Commission, the U.S. Environmental Protection Agency announced, through its Regional Counsel, intent to reopen the environmental assessment of the Northglenn Reuse project. Shortly thereafter EPA issued a "Draft Directive of Work" which was to guide the preparation of the environ- mental assessment. EPA, through its project officer for the Northglenn Reuse System, requested review comments from the LWRCOG on the "Draft Directive of Work". On 25 May 1979 the LWRCOG submitted its detailed comments (Attachment 4). The focus of LWRCOG's questions and comments was to assist EPA

6. Northglenn's proposal is not simply a conventional secondary treatment and discharge to a canal. It includes the provision that the discharge is only made during irrigation demand and that the discharge not occur during canal wasting. (Canal water overflow into the Little Dry Creek system and hence to the South Platte system.) As responded to in the previous comment, Northglenn complies with the commitment to agricultural reuse by virtue of a contingency plan designed to reuse the effluent entirely on land in Northglenn's control if there is insufficient irrigation demand. (See Chapter 5, Mitigating Measures.) The specific components of the Northglenn proposal which are eligible for alternative treatment technology are listed in Chpater 6, EPA Funding Criteria and Analysis. Those components entirely associated with agricultural reuse are eligible for the 85 percent grant. This includes the Bull Canal wastewater storage reservoir and those mitigation measures regarding reuse.

7. The response to your May 25, 1979 letter which recommends additional studies as part of the Directive of Work for the consultant is attached as a separate response.

7

in defining the need for the project, the availability of other alternative water supply and waste treatment, and ensuring that a thorough and accurate examination of significant environmental impacts was initiated. LWRCOG was told by EPA that the substance of these comments would be included in their entirety in the "Final Directive" of Work or the "Scope of Services - Work Plan" under which the consultant would contractually perform all required tasks.

We have compared the content of the Draft Environmental Impact Statement with the "Directive of Work" for the environmental assessment and the consultants' Final Work Plan. We believe that EPA has not identified or sufficiently addressed major issues which were brought to its attention during the preparation of the Work Plan to guide the development of the environmental assessment in May of 1979.

Specific issues which LWRCOG asked EPA to address and which are contained in the LWRCOG comments on the Draft Directive of Work include, the following:

1. Need for the project including examination of the availability of alternative sources of waste treatment and water supply for the City of Northglenn.
2. Overall quantitative impacts to agriculture as a result of implementing the Northglenn reuse program.
3. Requirements of NPDES Permit to ensure proper operation of system, including mitigation measures.
4. Feasibility of other communities in the Denver area proposing similar type reuse systems to gain a source of water supply.
5. Full disclosure of the sizing and operational characteristics of the proposed treatment system - evaluation of system design, including reuse as parts of the proposal.
6. Feasibility of requiring additional treatment processes if the system does not operate as intended and in compliance with NPDES permit requirements including remedial action plans in case of system failure.

REQUESTED RESPONSE: We request EPA to address each issue previously raised by LWRCOG; and if appropriate, refine or expand the scope of such response based upon actions taken in the LWRCOG request for compliance with the "scoping" requirements of the November 6, 1979 NEPA regulations (see Issue 5 which follows).

8

5. **EPA COMPLIANCE WITH NEPA REGULATIONS COVERING PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS.**

On November 28, 1978, the Council on Environmental Quality promulgated rules covering the uniform procedures for implementing the procedural provisions of the National Environmental Policy Act. These regulations, which became effective July 30, 1979 require agencies to comply with "scoping" procedures after the agency determines that an Environmental Impact Statement will be prepared (40 CFR 1501.07).

Such "scoping" procedures are to assist in determining the scope of the EIS and for identifying the significant issues related to the proposed actions.

Federal regulations implementing the CEQ rules were promulgated by EPA on November 6, 1979. These regulations became effective on December 15, 1979 nearly one month before EPA's determination to prepare an Environmental Impact Statement on this project.

In a memorandum dated January 4, 1980 EPA gave notice of its intent to prepare an Environmental Impact Statement on the Northglenn Project. Notice was subsequently published in the Federal Register on January 11, 1980. Between the January 11 and February 19, 1980 LWRCOG was not notified by EPA of any scoping procedures which are required by federal regulation. We therefore question the legality of the public hearing held on February ~~10~~ 13, 1980.

In fact LWRCOG has not been provided with the environmental assessment which EPA is required by federal regulation to use in the determination of whether an EIS is required. LWRCOG did however, receive one copy of a report entitled Preliminary Environmental Report Northglenn Water Management Program dated November 1979. To our knowledge such a document has never been released in final form nor does it have recognition as an environmental assessment in the NEPA regulations.

REQUESTED RESPONSE: We ask EPA to justify its actions and to provide documentation of its compliance with scoping requirements of the NEPA implementing regulations, in the determination to prepare an Environmental Impact Statement on the Northglenn Reuse Proposal.

8. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

9

6. RECOMMENDED STREAM CLASSIFICATIONS FOR THE BULL CANAL

EPA states at page 40 of the Draft Statement that,

> "Filings have not been made to change the use of the Bull Canal waters to a water supply and the current Larimer-Weld Clean Water Plan designates the Canal solely for agricultural use. Thus, it is EPA's conclusion that the protection of these waters for a potential source of future water supply source is unnecessary and EPA recommends that Frederick explore other options to satisfy future water supply demands."

We wish to remind EPA that the LWRCOG has no final authority in the determination of stream standards or in the assignment of stream classifications. This authority rests with the State of Colorado through the Colorado Water Quality Control Commission. The LWRCOG as a State Management and Planning Region and as a designated 208 planning agency is, however, a participant in making recommendations for such water quality standards and stream classifications. At present, the Colorado Water Quality Control Commission has not assigned a use classification to the Bull Canal or numeric standards to be achieved.

While the Larimer-Weld Regional Council of Governments recognizes the importance of maintaining or improving the quality of water in the Region consistent with recommendations of its adopted 208 Plan, there has been no recommendation (as noted at page 40) to designate the Bull Canal solely for agricultural use. It is the position of the LWRCOG 208 APC that ditches and canals not be classified unless the proposed use designation is to protect an existing use or a legitimate future anticipated use such as water supply.

The Colorado Water Quality Control Commission is expected to hold stream reclassification hearings on the South Platte River and tributaries sometime in June or July of 1980. Petitions to classify the Bull Canal, if appropriate, should be made at that time through a public participation and administrative review process as required by both state and federal law. The future of such a proposal to classify the Bull Canal should not be superceded by EPA through administrative action on a proposed waste treatment project.

Compliance with procedural requirements of the law makes EPA's conclusion regarding no protection of these waters as a potential future water supply improper. We believe that the concerns of the Town of Frederick for seeking out a future water supply are of equal importance to those of the City of Northglenn which allegedly lead it to the initiation of this water reuse program. In addition, we believe that the City of Fort Lupton's concern about protecting its future source of water supply is also important.

9. The administrative procedure for classification of state waters which requires a request for designation to the State Water Quality Control Commission can be initiated by the Larimer-Weld Council of Governments. Such a procedure could have resulted in reclassification of the Bull Canal as a water supply source. Currently the state has not received any requests for the reclassifying of Bull Canal to a water supply source. As the EIS recognizes, such a classification would likely prohibit the project. To achieve water supply quality with 100 percent effluent would be cost prohibitive. EPA investigated the changes in water quality in the Bull Canal that would adversely affect the Town of Frederick and the City of Fort Lupton. There is no change in the results indicated in the draft EIS. Fort Lupton's supply will not be significantly impacted as a result of receiving some small portion of flow into Sand Creek Reservoir from overflow from the Bull Canal. Such a small loading will not affect nitrate concentrations significantly within Sand Creek Reservoir. The City of Frederick, on the other hand, will find it uneconomical to take the Bull Canal water and utilize it for a domestic water supply source, therefore, the city should look elsewhere for another water supply source. EPA has no evidence that administrative steps have been taken to protect this canal for a public water supply. Therefore, it remains EPA's position that the project can proceed on the basis that the Bull Canal need not be protected as a domestic water source.

9 **REQUESTED RESPONSE:**

1. EPA should clarify the stream classification process in the Final Environmental Impact Statement, and consider the effects of a proposed classification for water supply on the viability of the Northglenn proposal and required NPDES permit conditions.

2. EPA should investigate in detail the present and projected expenditures of the Town of Frederick and the City of Fort Lupton to make the Bull Canal or hydrologically connected water bodies a future source of domestic water supply. This investigation should include the federally financed improvements made to Firestone Reservoir and the foreclosure on options (if any) to use those facilities by making the Bull Canal unsuitable for water supply purposes. The investigation should also focus on the feasibility and costs to Firestone in searching out an alternative water supply.

3. We ask EPA to defer determination of NPDES Permit requirements until after the State of Colorado makes a decision on the use classification of Bull Canal and hydrologically connected water bodies below the proposed Northglenn facility discharge point.

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7. **REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENT ON NPDES PERMIT CONDITIONS**

If the Northglenn facility is constructed, the EPA through the State of Colorado will be required to issue an NPDES Permit to the City of Northglenn to ensure compliance with appropriate sections of the Federal Clean Watep Act. Based upon limited information contained in the Draft Environmental Impact Statement about the quality of the discharge effluent and the potential effects of the discharge on downstream water uses, we believe that it is appropriate for EPA to examine in consultation with the State of Colorado the specific effluent limits of that anticipated NPDES Permit.

We find it impossible for EPA to determine the effects of the facility on public health and agriculture without a thorough examination of the required effluent limits needed tm protect downstream water uses. Because of these concerns it would be appropriate to examine the required NPDES effluent limits and determine the ability of the proposed waste treatment system to meet those limits, prior to a decision to award a grant for the construction of the facility. This uould be most easily accomplished in the context of the existing Environmental Impact Statement.

10. EPA considered various discharge permit requirements to insure the public health is protected and concluded that the state's draft permit which included 1000 fecal coliforms per 100 milliliters would be insufficient to adequately protect public health. A more stringent requirement of 200 fecal coliforms per 100 milliliters is appropriate. In addition various grant conditions which were recommended in the draft EIS will be negotiated with the Colorado Health Department and may be incorporated into the NPDES permit to provide enforceability. This final EIS can be considered the decision document and evaluation of both the grant action and the state's permit action. (See Chapter 5, Mitigating Measures.)

REQUESTED RESPONSE: We request EPA to consider the feasibility of preparing an Environmental Impact Statement of the Northglenn NPDES with the following questions in mind:

1. Are there provisions for the examination of the NPDES Permit issuance and compliance under the NEPA?
2. What are the responsibilities of EPA and the State of Colorado in that process?
3. Must a decision to prepare an Environmental Impact Statement for an NPDES Permit be considered an action independent of a decision to award a construction grant?
4. Will EPA in consultation with the State expand the scope of the current Environmental Impact Statement to include the determination of specific conditions of the NPDES Permit? If not, why?

8. MANAGEMNENT AGENCY DESIGNATION FOR THE NORTHGLENN PROJECT

The LWRCOG is a designated water quality management planning agency with a locally adopted, state certified and EPA approved 208 Areawide Water Quality Management Plan. As the guardian of the Plan, LWRCOG is concerned that the integrity of its Plan, which was developed at great financial cost and with extensive public participation, is maintained in accordance with the desires of local governments which have adopted it. We are also concerned that the Plan meets the complex needs of responsible water pollution control planning as envisioned by the federal Clean Water Act.

11 We are in general agreement with EPA's conclusion of joint management agency designation of Weld County and the City of Northglenn for carrying out certain responsibilities under their respective controlling 208 plans. However, EPA's preferred Alternative 3 (at page 96) does not fully disclose the responsibilities of Northglenn and Weld County in the detail included in Alternative 1, especially as these responsibilities may relate to future reviews, and approvals of facility expansions, construction priorities and siting and operational characteristics of any proposed wastewater systems. While it is anticipated that these requirements will of necessity be included in an IGA, we request that EPA clarify its position with regard to the essential elements of management agency authority for both point and non-point source pollution control. We wish to work closely with EPA in examining this issue.

11. EPA believes that similar wastewater reuse systems may be feasible in the Denver Metropolitan area. It is not within the context of this Environmental Impact Statement to speculate or identify the development of such plans. In the future, such plans, if submitted to EPA, will be evaluated similar to the Northglenn proposal as to their acceptability for public health, water quality protection, permit compliance, enforceable requirements of the Act and environmental effects.

EPA will still require the execution of an intergovernmental agreement between Weld County and the City of Northglenn prior to final payment of the Step III grant. The legal and administrative costs will be analyzed at that time and if mutually acceptable such administrative burdens can be placed upon the City of Northglenn. EPA believes the burden created on Weld County from Northglenn's facility is the responsibility of the City of Northglenn.

11 If EPA awards the City of Northglenn a construction grant for the proposed facility under its "Multiple Use" or "Alternative Technology" provisions, it will by its actions define the project as one requiring some non-point, pollution control management responsibilities for reclamation and reuse. The system operation, as proposed by EPA would place Weld County and/or possibly the State Health Department in a position of non-point pollution control management or enforcement requiring great expense and administrative attention, with no resources to accomplish those functions. It is our belief that Northglenn should pay the full amount and all costs to Weld County as a management agency and the LWRCOG as the planning agency to participate in this "unique" approach to wastewater treatment.

EPA's management agency designation will establish a precedent for interjurisdiction authorities and relationships between adopted 208 Plans. Other future proposals by growing municipalities who desire to dispose of wastewaters outside their political jurisdictions will be guided by EPA's precedent.

REQUESTED RESPONSE:

1) We ask EPA to expand upon the intent of Alternative 3 in the Draft Environmental Impact Statement and to examine the long-term implications of its 208 management agency designation especially as it may affect future so called "alternative technology" and "multiple use" proposals by growing municipalities on the fringe of the Denver Metropolitan Area who propose water supply motivated wastewater pollution control or sludge application facilities in Southern Weld County.

2) We ask EPA to look carefully at the legal issues and administrative costs placed upon local and state governments which result from the implementation of new large scale reuse or reclamation programs that convert point source to non-point source pollution control problems.

3) Specifically, we request that EPA examine the burdens of planning, management and enforcement of water pollution control that evolve from this approval for waste treatment management. Out of this examination should come a recommended course of action for long-term financing of the Northglenn wastetreatment program if constructed in Weld County.

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8. CONDITIONS FOR EPA GRANT APPROVAL, IGA AND NPDES PERMIT

Three distinct mechanisms are available to ensure that adverse environmental effects of the proposed project are mitigated. If it is determined that the Northglenn wastewater treatment facility will be constructed, irrespective of an EPA grant award, the following conditions must be met:

1. An NPDES permit must be issued by the Colorado State Health Department and approved by EPA. The permit will specify the location, magnitude and quality of the discharge.

2. An intergovernmental agreement (IGA) between the City of Northglenn (as an operations agency in Weld County) and Weld County (as a management agency) must be negotiated. The agreement will specify the conditions under which the parties will allow the facility to be constructed, operated, maintained and monitored consistent with the Larimer-Weld 208 Plan and the State issued NPDES permit for the facility.

If an EPA construction grant is awarded, additional requirements may be placed upon Northglenn through grant conditions. EPA proposes that a series of public health issues and operational requirements of the wastewater project be addressed as grant conditions to ensure compliance by the City of Northglenn. Several of these conditions require immediate capital expenditures by the City of Northglenn; others require a long-term financial commitment, monitoring responsibilities and possible enforcement measures to ensure compliance. While Northglenn has given its good faith intent to meet any and all conditions, we question the ability of EPA to enforce a violation of the conditions of grant approval and compliance. Once EPA closes out the grant or the grantee expends the greater portion of the grant, EPA has little or no practical recourse to force the grantee to meet the agreed upon conditions. Failure of compliance may then become a matter for the courts if EPA elects to use its discretionary administration capabilities to bring the grantee into compliance with conditions of the grant award. To our knowledge EPA Region VIII has never exercised that authority, nor is it a practical approach. Issues which EPA proposes to be covered as grant conditions may also be addressed in an IGA or NPDES permit.

REQUESTED RESPONSE:

1) In consultation with LWRCOG we request that EPA identify in the Final Environmental Impact Statement the legal authority, administrative efficiency and practicality of placing various conditions for the construction, operation, maintenance and monitoring of the facility of

The Larimer-Weld Council of Government raises an excellent point with respect to the difficulty of enforcing long term EPA grant conditions. Following construction the agency finds it difficult to continually monitor these facilities and to have a requirement enforced over the design life period. In response to this request by Larimer-Weld Council of Governments EPA will negotiate to include several of the grant conditions previously identified in the draft impact statement to protect public health as requirements of the NPDES permit. Therefore the requirements for: limits on fecal coliform to 200 for 100 milliliters, the replacement or disinfection of Dacono's potable water system, the tailwater control plan, as well as limiting taps along the proposed new interceptor and limiting the rate of new taps within the city will be considered as requirements in the NPDES permit. Additional grant conditions will be required of the City which EPA feels it has adequate ability to enforce. The other items which are appropriate for inclusion in the inter governmental agreement will be subject to mutual consent between Weld County and Northglenn. Failure to execute an inter governmental agreement will result in withholding of partial payment for construction of these facilities. EPA, however, declines withholding of all payment until these conditions have been met.

each of the three (3) mechanisms (grant conditions, IGA, NPDES Permit) to ensure responsible waste treatment planning, management, facility construction and enforcement. Inclusion of these conditions in any combination of the three (3) instruments or all of them should be identified.

2. We request EPA to identify in detail the administrative requirements and costs necessary to implement the actual programs, or projects identified in the Draft Environmental Impact Statement which EPA feels should be included as grant conditions or part of an IGA between Weld County and the City of Northglenn (conditions as stated on p. 97 and other places they are referenced). These issues include the following:

    a. Fecal Coliform Limit.
    b. Sale and Distribution of Raw Edible Vegetables.
    c. Advisory for Agricultural Reuse.
    d. Replacement or Disinfection of Dacono Non-pollutable Water System.
    e. Tailwater Control.
    f. Land Use Authority.
    g. Sludge Disposal.
    h. Additional Monitoring Requirements.
    i. Protection of Groundwater Quality.
    j. Limits on New Interceptors.

3. We request that EPA withhold all grant payments to Northglenn until each grant condition has been met. In the event that EPA can not,by law,withhold all grant funds until complete compliance with conditions, we request that a graduated payment schedule be establisned. The schedule should include payment based upon acceptable completion of specific grant conditions. Failure to comply, if within the control of the City of Northglenn, should be accompanied by penalties.

City of
Thornton

8992 N Washington Street
Thornton, Colorado 80229
303) 289 5601

ATTACHMENT 1

January 31, 1980

Mr. Roger L. Williams
Regional Administrator
United States Environmental
Protection Agency
Region VIII
1860 Lincoln Street
Denver, CO 80295

Dear Sir:

The City of Thornton Utilities Board and City Council would like to take this opportunity to formally comment on the draft environmental impact statement regarding the proposed Northglenn Water Management System. Although we do not take exception to the management plan, we are concerned about certain statements about the level of service provided to Northglenn by Thornton.

There is an overriding concern about the quality of Thornton's finished water. It can be implied from the report that Thornton's water is in some way unsafe or unpotable. The City of Thornton's water supply currently meets or exceeds EPA Safe Drinking Water Standards. Planned improvements to our treatment process and raw water supply system ensure that Thornton will continue to meet the EPA standards.

There are also some comments in the plan regarding the ability of Thornton to adequately serve the City of Northglenn either now or in the future. The City of Thornton presently has the ability to serve the City of Northglenn and is capable of doing so in the future. The reason for the City of Thornton entering into a severance agreement with the City of Northglenn was not because of any stated need by the City of Thornton, this agreement was entered into only to accommodate the desires of our sister city. Thornton has the necessary plant and water resources to adequately serve the City of Northglenn. Enclosed is a letter from Mr. Wesley R. Brown, Chairman of the Thornton Utilities Board, to then Mayor-elect Odell Berry stating Thornton's continued willingness to serve.

"The City of Planned Progress"

We of the Thornton Utilities Department welcome the opportunity to further detail our views regarding the Northglenn Water Management Plan. The Utilities Department staff is presently conducting an in-depth review of the Environmental Impact Report and will make their factual correction available to your staff.

Sincerely,

Wesley H. Brown

Wesley H. Brown, Chairman
Utilities Board

Margaret W. Carpenter

Margaret W. Carpenter
Mayor

WRB, MRC/bs

Enclosure

City of
Thornton

[illegible] N. Washington Street
Thornton, Colorado [illegible]
[illegible]

November 26, 1979

Mayor-Elect Odell Barry
City of Northglenn
10701 Melody Drive
Northglenn, Colorado 80233

RE: Northglenn Utilities System

Dear Mayor-Elect Barry:

The Utilities Board of the City of Thornton has become concerned over various statements attributed to various public officials, editorials in the Sentinel Newspaper and letters to the editor of said newspaper concerning the high cost of the proposed Northglenn Utilities System and some inferences that Thornto was responsible for much of the proposed high cost and that there was no alternative at this point except for Northglenn to proceed.

First, in the most recent negotiations wherein the City of Thornton agreed to sell those certain utility lines owned by it which are located within the municipal boundaries of Northglenn, Thornton had the lines valued by what it considers competent engineering consulting firms. If the costs to purchase those lines and pay severence costs to Thornton were under estimated in the first instance by Northglenn, that certainly is not the fault of the City of Thornton.

On behalf of the Utilities Board, we are willing to have our representatives sit down with you to discuss the alternatives of Northglenn remaining on the Thornton utility system. This has not been previously negotiated between the two Cities, however, a recent editoria in the Sentinel indicated that this alternative was practically preclude This is not necessarily the case, for you must remember that in the past Thornton has always been able to provide Northglenn residents with adequate water and sewer service and to our knowledge Northglenn was one of the few if not the only entity in the State of Colorado which received water from its supplier at the same rates and charges that the supplier charged its own residents.

If you wish to sit down and discuss the alternative referred to above so that you could refer this to Northglenn's elected officials or to its people for determination, we stand ready to do this.

"The City of Planned Progress"

No one should be mislead to think that the alternative referred to above has been precluded when in fact it has not even been discussed.

Sincerely,

Wes Brown, Chairman
Utilities Board

WB/jp

cc: Sentinel Newspaper
Denver Post
Rocky Mountain News
Mayor Alvin Thomas
Mayor Tony Richter
Mayor-Elect Margaret Carpenter
City Manager Gerry Hagman

ATTACHMENT 2

WELD CO. COLORADO

OFFICE OF BOARD OF COUNTY COMMISSIONERS

PHONE (303) 356-4000 EXT. 200
P.O. BOX 758
GREELEY, COLORADO 80631

June 4, 1979

Mr. Harris Sherman, Chairman
Colorado Water Quality Control Commission
4210 East 11th Avenue
Denver, Colorado 80220

Dear Mr. Sherman and Members of the Commission:

RE: FY-1979 and FY-1980 Construction Grants Priority Lists --
City of Northglenn

Weld County wishes to comment on the current and proposed allocation of Construction Grants priority points for a waste treatment facility which is proposed within the political boundaries of Weld County. The City of Northglenn, a municipality located in Adams County, is proposing that facility. We seriously question the need for the facility and the manner in which the Water Quality Control Commission has allocated Construction Grants priority points to Northglenn for FY-1979; as well, we are concerned about the way the Commission may allocate points for FY-1980.

It is our understanding that the Commission approved the STEP 1-201 Facilities Plan for Northglenn over a year ago. However, EPA has not yet approved the funding to reimburse the City of Northglenn for the initial Plan preparation or the detailed design required in STEP II. We assume that EPA's actions are due to the fact that the Facilities Plan has not met a large number of conditions which are required for final 201 Plan approval.

We question the Commission's assignment of a total of 144 priority points to Northglenn. This places Northglenn as sixth out of 360 communities on the priority list and would dedicate over seven million dollars to its completion.

The Commission has stated that it is not the policy of the Commission to encourage the proliferation or the construction of new waste treatment plants, and that it is the policy of the Commission to encourage good local planning developed under Section 208 of the Clean Water Act (Section 5.3.3 - Grant Priority System). The Commission has also stated that it "will press vigorously for publicly owned treatment works to utilize treatment processes to reclaim and recycle municipal waste water in accordance with established water law and the appropriation doctrine of the State of Colorado" (Water Quality Control Commission Policy on Land Treatment of Municipal Waste Water, July 5, 1978).

Weld County specifically wishes to challenge the priority points allocated to the City of Northglenn in the context of the Commission's own policies and point allocation system.

(1) Project Points - 20 project points which have been assigned to Northglenn do not appear to be justified. We do not see that Northglenn has proposed "Treatment Beyond Secondary". The material presented thus far by Northglenn in its proposals indicate only secondary treatment with discharge to an irrigation ditch. Northglenn has publicly stated they only expect to meet simple secondary discharge requirements for an NPDES permit and must take no further responsibility for treatment after discharge to the ditch.

(2) Special Points - 95 points have been given to Northglenn in the Special Point category. Weld County does not believe these points were properly awarded.

50 points have been allocated for the completion of a STEP I-201 Facility Plan which allegedly demonstrates that the project is needed. EPA has reopened the Negative Declaration prepared for the initial 201 Plan submitted by Northglenn. Among a number of issues which have been raised in the determination to reopen EPA's decision was the need for the project. Northglenn's wastes are currently treated at Denver Metro Sewage District. It is our understanding that there is adequate capacity at this facility to continue doing so well into the future.

Another 45 points have been allocated to Northglenn for "water reuse". Reuse of water is already occurring throughout Weld County and has been performed for many years in the context of Colorado water law. We believe the Northglenn proposal would only change the location of a reuse from one hydrologic sub-basin to another and discharge it to an unclassified irrigation ditch. There are serious water rights issues associated with this proposal which deserve careful consideration.

We would urge the Commission to again consult its own policies on reuse and land treatment to determine whether this project really qualifies as a project "which results in substantial and effective upgrading of the effluent prior to discharge" and reclaims water in accordance with established water law. The reuse benefits of whether the discharge is to a natural water course or an irrigation ditch are ones which should be addressed in the context of all existing or anticipated beneficial uses of that water.

Weld County believes that the allocation of Construction Grants priority points for Northglenn should be revised:

(1) It is clear that the project, as it is proposed, is not providing "treatment beyond secondary" and is, therefore, not entitled to 20 project points.

(2) The completed facility plan does not conclusively demonstrate need for this waste treatment project as intended in the Federal Clean Water Act. It is, therefore, not entitled to 50 points for having a completed 201 Facilities Plan.

(3) Weld County also believes the Northglenn proposal is not a "reuse" project in the context of the Commission's written definition of reuse (Section 5.3.6) nor in the context of historic water use practices that

have been followed in Northern Colorado for many years. Therefore, Northglenn should not be entitled to 45 points for "reuse".

In summary, the City of Northglenn is eligible only to 29 population points for the FY-1980 funding list. And, because of the recent opening of the 201 Plan Negative Declaration by EPA, we do not believe the need for the project has been sufficiently documented to permit it to be funded on the FY-1979 priority list at this time. We also believe that sufficient evidence may be presented in the forthcoming EPA Environmental Assessment that a public hearing should be scheduled in accordance with paragraph 3, Section 5.3.5 item (9) of the Commission's Priority System Procedures to determine whether the project is needed.

We thank you for the opportunity to comment on this important subject.

Very truly yours,

The Board of Weld County Commissioners

Leonard L. Roe

Leonard L. Roe, County Commissioner

LLR: clb

cc Jonathan Rutstein, Larimer-Weld Regional Council of Governments
Alan Merson, Regional Administrator, Environmental Protection Agency

ATTACHMENT 3

LARIMER - WELD REGIONAL COUNCIL OF GOVERNMENTS
PHONE (303) 667-3288
ROOM 201
201 EAST 4th STREET
LOVELAND, COLORADO 80537

May 25, 1979

Mr. Weston W. Wilson
Environmental Evaluations Branch
Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, CO 50295

Dear Mr. Wilson:

RE: DRAFT DIRECTIVE OF WORK NORTHGLENN WATER MANAGEMENT PROGRAM -
FACILITY PLANNING/ENVIRONMENTAL ASSESSMENT

The Larimer-Weld Regional Council of Governments through its staff and 208 Advisory Committee has reviewed the "Draft Directive of Work" for the Northglenn Water Reuse Project and has a number of detailed comments. The review focused on the need to evaluate the Northglenn project in the context of a major project which may create widespread impacts to both water supply and water quality in the Larimer-Weld Region and affected portions of the South Platte River Basin. The Council of Governments wishes to have a full disclosure of the Northglenn project, including justification of need for the project for both water supply and water treatment and other related activities to be undertaken by FRICO which are dependent upon the successful implementation of the Northglenn reuse system. The concern in this regard has been amplified by recent discussion on the project before the Colorado Water Quality Control Commission, Weld County Government and the COG itself.

1 It has been extremely hard for the public and technical staffs to evaluate the project because major features of the plan keep changing and in many cases have not been sufficiently documented in writing to permit a detailed and accurate assessment. We are in hopes that the effort currently being undertaken by EPA will assist interested parties in quantifying and qualifying the anticipated impacts of the project.

Attached to this letter is a detailed comment of the EPA "Directive of Work" which was prepared by a subcommittee of the Larimer-Weld 208 Advisory Committee.

RESPONSE: 1. EPA appreciates Larimer-Weld Regional Council of Governments continued interest in the development of the Northglenn Water Management Program Environmental Impact Statement. Many of the major issues and complications of this project are presented in the draft Environmental Impact Statement which has been prepared pursuant to the EPA Directive Work reviewed by the Larimer Weld Regional Council of Governments. Specific work elements addressed in the letter to EPA regarding the workplan are presented below.

1 We hope the information we have provided you will be helpful in structuring an objective evaluation of the environmental impacts of the Northglenn plan. The Larimer-Weld COG looks forward to assisting you in the review of this far-reaching project.

Very truly yours,

Irma L. Princic
Chairperson, LWRCOG

IP:sks
Enclosure

cc: Norman Carlson, Chairman, Board of Weld County Commissioners
Gary Fortner, Weld County Planning Director
Tom David, Weld County Attorney
W. D. Farr, Sr., Chairman, Larimer-Weld 208 APC
Rick Claggett, EPA 208 Project Officer
Jim Brooks, EPA Construction Grants

COMMENTS AND REVISIONS TO EPA "DRAFT DIRECTIVE OF WORK"

FOR NORTHGLENN WATER MANAGEMENT PROGRAM

The comments which follow are recommendations for modification of the "Directive of Work" submitted to the Larimer-Weld 208 Areawide Planning Committee on 17 May 1979 by Region VIII EPA. These comments have been prepared at the request of the EPA and represent a concensus of the persons listed on the attached sub-committee list. These comments are presented on behalf of the LWRCOG.

	PAGE REFERENCE		
2	(pp. 1-4)	Statement of Work (Comments on the overview statement.) Please identify the contractor if known at this time. Is the term contractor the same as consultant?	2. EPA has retained the services of Engineering-Science as an independent contractor to assist in the evaluation of the Northglenn Water Resource Management Plan and prepare a draft and final Environmental Impact Statement on the plan. Engineering-Science is not associated with any other element (construction, operation or implementation) of the Northglenn plan.
3	(p.1)	1. Existing Situation on Big Dry Creek Assuming the work effort is "fact finding" in nature and designed to identify the environmental impacts associated with the project, it is recommended that the assessment cover Existing and Projected Situation on the South Platte River System as it might be effected by implementation of the Northglenn project. The assessment should be quantitative as it relates to water flows, water uses and water quality within the effected portions of the Big Dry Creek from Standley Lake, its canals and the South Platte River from Denver Metro. The questions of water supply, changes in points of diversion and basin transfer of water threaten the entire prior appropriation doctrine of water rights in Colorado and may also affect water quality. NEED for the project as a water supply and waste water treatment project should also be documented including a full disclosure of the overall system and a summary of existing sources of water available to Northglenn, possible alternative sources other than FRICO water and a justification for the selected alternative.	3. Presented in the Environmental Impact Statement is a quantitative assessment of the impacts the project will have on water flows, water uses and water quality within the affected portions of Big Dry Creek from Standley Lake and the South Platte River. The questions raised by Larimer-Weld Regional Council of Governments regarding water supply, changes in points of diversion and basin transfer of water, and their effect on the prior appropriation doctrine of water rights in Colorado, is a subject which will be ultimately resolved in the water courts. The need for the project as a water supply and wastewater treatment project is developed and presented in Chapter 2 purpose and Need. A summary of the existing sources of water available to Northglenn are presented in the alternative section Chapter 3.
4	(p.2)	2. Impacts to Agricultural Productivity The quantitative analysis on water quality/quality changes should be compared against three options, not just two. Other alternatives for water purchase exist besides condemnation. Outright purchase should be clarified and explored.	4. The impacts to agricultural productivity have been quantitatively analyzed for three options. The three options include acquiring water from nontributary wells, tributary well fields,adjacent to the South Platte River, and purchase or condemnation of FRICO water. Impacts to agricultural productivity are also evaluated for the following water supply options: obtaining water from the Denver Water Board, obtaining water from the Wind Gap project, and obtaining water from Thornton. Data deficiencies for these options results in a semi-quantitative assessment of agricultural productivity. These evaluations are presented in the final Environmental Impact Statement under the agricultural productivity section.
5	(p.2)	3. Public Health Impacts The language in this overview should be expanded to reflect an assessment of the quality and quality (existing and projected) of source water for use, make-up and reuse in the proposed system. Effects on public health should be analyzed including potential for adverse impacts to existing and anticipated water uses from nutrients (including nitrates), bacteria, viruses, pathogens, heavy metals and formation of trihalomethanes.	

PAGE REFERENCE

5 (p.3) Recommendations for mitigation should include changes in NPDES permit conditions, major and minor design changes, or operational flexibility required to mitigate adverse impacts.

6 (p.3) 4. Direct Impact of the Waste Water Treatment Facilities

b. Odor should be evaluated for both ability to meet state regulations and objectionable levels which may currently be below regulatory limits.

Other comments and additions to this section are included in the detailed evaluation of Task E.

7 (p.3) 5. Public Participation Program

The following change is suggested:

"A full scale public participation program will be carried out with initial direction from LWRCOG and DRCOG. All responsibilities for carrying out the program will rest with a public participation coordinator mutually acceptable to LWRCOG and DRCOG. He will be provided assistance from the consultant and will follow the provisions of 40CFR Part 35 Sub-Part E, Section 35.917-5."

8 (p.3) 6. Recommendations

Please clarify the first sentence. Modify the second sentence as follows:

"The recommendations will consider the need for--

(a) Further analysis of existing data,
(b) Acquisition of new data and further study,
(c) Changes in project operation or design which will mitigate adverse impacts, and
(d) Mediation between any parties having interests in conflict and methods by which such mediation could occur."

(In no way should the consultant or contractor be considered as the mediator!)

Specifications

9 (p.4) Add to Municipalities:

"Town of Frederick, Town of Firestone, Town of Dacono, City of Fort Lupton"

Add to other Multipurpose Governments:

"Larimer-Weld Council of Governments"
"State of Colorado 208 Executive Committee"

Add to Other Federal Agencies:

U.S. Bureau of Reclamation"

Add to Special Purpose Districts:

Soil Conservation Districts and Rural Domestic Water Supply Organizations

(The contractor will have to check to see which ones are involved.)

5. EPA has conducted all extensive analysis of the public health impacts associated with the proposed Northglenn Water Resource Management Program. This analysis has ranged from literature searches, consultation with noted authorities in the field, and in-depth analysis of treatment technologies and operational features of the plan. All of the impacts and mitigation measures are presented in the final Environmental Impact Statement under Operational Criteria of the Proposed Treatment System, Public Health Aspects of the Project, and Mitigation Measures for identified public health impacts.

6. Chapter 4 presents an evaluation of the odor impacts associated with wastewater treatment facilities. EPA believes the information presented is suitable for determining the odor impacts of the treatment facility. Mitigation measures are addressed in the treatment plan operation section of the final Environmental Impact Statement.

7. Early in the environmental review process of the Northglenn project EPA requested public participation of all vested interest groups including the Larimer-Weld Regional Council of Governments and the Denver Regional Council Goverments. During that process an attempt was made to identify an acceptable public participation coordinator that was mutually acceptable to both Regional Council of Governments. Unfortunately, an acceptable coordinator could not be identified and EPA's Project Officer took the lead role as public participation coordinator.

8. Recommendations to EPA were made by the Contractor for items a, b, and c and analyzed in the final EIS. The need for mediation supplied at EPA expense has not yet been determined.

9. All of these modifications suggested by Larimer-Weld Regional Council of Governments were made to the Directive of Work and are incorporated into the preparation of the final Environmental Impact Statement.

PAGE REFERENCE

9 (p.4) The last paragraph should be rewritten to reflect the following changes: "The public participation program will involve at least the contractor, Northglenn and its consultants, the cities of Thornton and Westminster, Fort Lupton, the Towns of Firestone, Frederick, Dacono, Adams County, Weld County, DRCOG, LWRCOG, the Colorado State Health Department and other public interest or special interest groups. A technical advisory group will be established from knowledgeable representatives identified above and other interested organizations. The function of the advisory group will be to advise the consultant on alternatives to be considered and evaluate information developed in the course of the study."

(Possibly other functions acceptable to LWRCOG and DRCOG.)

10 (p.5) 2. Data Gathering Program - Studies

Add as a minimum the following studies and reports:

1. "Areawide Water Quality Management Plan for Larimer and Weld Counties, Colorado, and adopted revisions", September, 1978, Larimer-Weld Regional Council of Governments. Including supporting documents, specifically:
    a. W.Q.M.P. Interim Report #5, "Institutional Inventories for 208 Functions", April, 1977, Briscoe, Maphis, Murray & Lamont, Inc.
    b. W.Q.M.P. Interim Report #17. "Institutional and Financial Recommendations for Control of Pollutants from Non-Point Sources and Municipal and Industrial Point Sources", January, 1978, Briscoe, Maphis, Murray & Lamont, Inc.
    c. Letter of Plan certification by Governor Richard Lamm.
    d. Letter of Plan approval by Regional EPA Administrator.
2. "Draft State Framework Plan for Water Quality Management", April, 1979, State of Colorado 208 Coordinating Unit.

11 (p.6 second paragraph) 3. Quality of Reports

Please clarify the intent and purpose of the statement:

"The report will include specific actions dealing with data needs and a land treatment/reuse evaluation of the Clear Creek plans."

12 (p.7) 4. Period of Performance

Timing and number of advisory group meetings should be stated here. We suggest at least four meetings.

Revise activities for end of 1st month to read:

10. The five documents identified by Larimer-Weld Regional Council of Governments have been reviewed as part of the preparation of the final Environmental Impact Statement. In addition numerous other data sources have been obtained and reviewed which are referenced throughout the EIS.

11. The EPA acknowledges a typographical error in the draft Directive of Work. The statement should read as follows: "The report will include specific actions dealing with data needs and a land treatment/reuse evaluation of the Northglenn plan."

12. EPA has held and conducted two public participation meetings in addition to three discussion panel meetings to review and discuss pertinent issues of the Northglenn Water Resource Management plan.

PAGE REFERENCE

12 "Initiate Tasks A and B and where possible complete Sub-Tasks involving data collection and scoping meetings. Public participation Sub-Tasks and data evaluation will be continuous."

13 (p.8) 7. Draft Reports
ALL participants should be provided copies of the Draft report by the contractor or EPA. This should be done to insure that there is reasonable concurrance by the advisory group before the report is publicly distributed.

14 (p.8) 9. Miscellaneous Provisions

a. Personnel - Qualifications of the personnel involved should be presented to assure compliance with the expertise required to do the work - resumes should be prepared and submitted to the EPA Project Officer.

(p.9) b. Meetings - Meetings requiring Advisory Committee members should be scheduled to permit high attendance (evening meetings would be preferrable and in a central location to the majority of committee members).

(pp. 10-13) ATTACHMENT 1 (General Comments)

15 I. BACKGROUND
There must be an explicit description of the project which may become the subject of an Environmental Impact Statement.

The summary section here contains information which is not all documented in the 201 Facilities Plan as submitted for public comment, the EPA Negative Declaration prepared in September of 1978 or in other formal documents prepared by the City of Northglenn for public review.

In order for the contractor and the public to evaluate the project accurately, they must know the finite components of the proposed Northglenn system and any associated activities by FRICO, Northglenn, Westminster, Thornton and others which are dependent upon successful implementation of the Northglenn project. The identification of these issues must be considered an integral part of the environmental assessment.

It is therefore recommended that a full disclosure of the proposal and associated activities which may affect the feasibility of the project completion be made. At a minimum it should cover the following areas:

(1) Need for the project - can Northglenn adequately be given waste treatment service from existing service entities?

(2) Is the proposed water supply component of Northglenn's project the only way to satisfy future water supply needs?

13. During the public participation process EPA provided information to the public and discussion panel in the form of the technical handouts as well as oral presentations. The discussion panel group was requested to provide to EPA their input into the preparation of the Environmental Impact Statement.

14. EPA assembled qualified personnel, through consultants and within its own staff, to perform the evaluation and analysis of the Northglenn Water Resource Management plan. Personnel included people who were noted experts in their respective fields of wastewater treatment, agricultural production, water quality, hydrology, water rights, cost analysis and water supply. Meetings were scheduled during the public participation process for maximum attendance of all vested interests involved in the Northglenn Water Resource Management plan.

15. EPA recognizes that much of the preliminary information concerning the Northglenn Water Resource Management plan was fragmented and it was difficult to comprehend the full nature of the project. EPA further believes that the final Environmental Impact Statement provides a full disclosure of the proposed project and associated activities. Elements relating to the needs of the project are discussed in Chapter 2.

As discussed in Chapter 5, Alternatives, the proposed project is not the only alternative whereby Northglenn can satisfy its future water supply needs; however, it has been demonstrated to be the most cost effective option available to Northglenn.

The operational features and sources of water for the proposed Northglenn system are discussed and presented in the final Environmental Impact Statement.

Specific features such as the lining of the Bull Canal have been previously addressed. EPA does not feel that the Bull Canal lining is an integral part of the Northglenn project but rather is an action being undertaken by a private entity.

PAGE REFERENCE

15 (3) The sources, quantity, quality and distribution features (intra and inter basin) should be identified plus any modifications to these features through canal lining and inter-basin transfers of water by purchase or exchange.

(4) The feasibility of other entities either participating in the proposed Northglenn system or proposing similar water reuse systems themselves.

(5) Sizing of all design components.

Sources of the information used in preparing the summary should be formally referenced. For example, chlorination, to our knowledge, was only considered after the Negative Declaration was prepared and the question of public health raised within the Larimer-Weld region. The specifics of sludge disposal were not adequately discussed, only vague references made to sludge usage in Northglenn. The size of the reservoir has varied from under 5,000 acre feet to over 6,000 acre feet. The ability to store and treat urban run-off, and Northglenn waste water and release it in a timely manner has been discussed only generally. As well, the responsibilities of Northglenn for monitoring surface and ground water quality at the treatment site and within the "reuse" portion of the system have not been discussed and formally documented in the 201 Plan. The ability of the City of Northglenn to successfully meet all EPA conditions specified in the Negative Declaration of September, 1978, has never been publicly disclosed.

II. 201/ENVIRONMENTAL ASSESSMENT STUDY TASK DESCRIPTION

16 (p.14) The second paragraph should read as follows:

> "The public involvement program is intended to comply with the final public involvement regulations published on August 7, 1978 (give citation). In order to accomplish this..."

The public participation coordination should be under the immediate control of EPA. This function should be funded entirely from EPA funds. The selection of the coordinator should rest with DRCOG and LWRCOG to maintain objectivity. In this scenario Northglenn would not be the "grantee". EPA would maintain full control of all contracted activities.

17 (p.17) Sub-Task A.2 Establish Advisory Group

EPA should explore a means of reimbursing the advisory group members for expenses (travel, etc.) incurred in the review of the project.

EPA, through the contractor, should be responsible for establishing the size and composition of the advisory group with the concurrence of LWRCOG and DRCOG. Committee composition should be acceptable to Weld County and the City of Northglenn.

18 (p.18) Task B - Data Gathering

It is our understanding that this task will identify in detail the adequacy of existing data and recommend future data gathering if required to sat-

EPA does not believe that there is any feasibility in other entities participating in the proposed Northglenn system at this time.

EPA believes that similar wastewater reuse systems may be feasible but it is not within the scope of this Environmental Impact Statement to speculatively identify or address the development of such plans.

The sizing of plan components is presented in the final design of the proposed wastewater and water supply systems.

The sources of information utilized within the preparation of the Environmental Impact Statement are appropriately referenced.

The final Environmental Impact Statement does present a discussion of the sludge management plan for the Northglenn project which is presented in Chapter 4.

The size of the reservoir has varied due to variations in the amount of water that would be stored. The actual storage volume of the reservoir has been designed based on the need to store Northglenn's wastewater, the urban stormwater runoff and capacities required to provide storage for the FRICO water exchange.

The release of discharges will vary annually and the determination of timely releases is part of the operational features of the project. Therefore it is not possible at this time to specifically comment or develop that program.

Northglenn is committed to developing and implementing a surface and groundwater monitoring program both adjacent to the treatment site and within the reuse areas of the project. This information is presented in the mitigation section of the EIS.

16. EPA attempted to coordinate the public participation program with the Denver Regional Council of Governments and the Larimer-Weld Regional Council of Governments. That effort did not result in the identification of mutually acceptable public participation coordinator. Consequently, EPA designated the Project Officer as the public participation coordinator.

17. The problem of providing reimbursement for the advisory panel members was not raised by the panel. EPA believes that the selected advisory panel represented most of the various vested interest groups and was acceptable to Weld County and the City of Northglenn.

PAGE REFERENCE

isfactorily answer questions involving "primary impacts".

18 (p.18) Sub-Task B.1

It is assumed that the responsibility of gathering information is the burden of the proposers of the project and EPA's consultant for the environmental assessment. The information gathered must be objectively presented. Where questions of objectivity are raised, the consultant, advisory group and EPA should evaluate the information and recommend future required actions.

19 (p.19) Task C - Define Impacts to Agricultural Productivity
The scope of this task should be all portions of the South Platte River Basin affected by the consumptive use, inter-basin transfer of water (including effects to groundwater recharge by drying up land) and water quality changes anticipated by implementation of the project. These impacts should be comprehensively discussed for their long and short-term impacts to agricultural production and agricultural land conversions. The discussion should include reduced or increased productivity to individual crops, possible limitations to kinds of crops grown due to conversion from irrigated to dry land farming, and possible constraints placed on production from degraded water quality.

Sub-Task C.1 b. Water Quality

This task should be amplified to include an analytical discussion of the specific water quality parameters, if any, which may restrict the types of crops grown or impair crop usage for human or animal consumption.

20 (p.20) Sub-Task C.1 c. Economic Changes (suggested new task)

It is recommended that this sub-task be made a separate task of equal standing to other tasks listed. It should appear prior to the existing Task C. It should contain a discussion and analysis of all economic changes not just agriculture. The scope of the task should reflect costs and benefits to agriculture, municipal water uses (including capital investments and operations and maintenance), land use changes, etc.

If it is possible to model parts or all of this economic analysis with an existing input/output model, reference the source model. If a new model will be constructed for this purpose, it will most likely be costly and time consuming - please clarify this activity.

Sub-Task C.1 d. Land Use Changes

This analysis should be done for several frequency level dry years, to determine severity of problem.

Sub-Task C.2

These impacts should be compared against each other as "least cost solutions".

18. EPA and its consultant have collected all pertinent data for the preparation of the Environmental Impact Statement. Determinations were made relative to the adequacy of this information and supplemental information was requested from the City of Northglenn and their consultants regarding pertinent elements of the project. The information is objectively analyzed in the EIS.

19. The agricultural productivity analysis presented in the Environmental Impact Statement is detailed relative to consumptive use, farm headgate deliveries and various impacts on agriculture as a result of transferring water from the South Platte River to the FRICO system. While it is not in-depth and comprehensive in terms of long and short term impacts to agriculture and agricultural land conversions, EPA believes that the analysis is comprehensive for assessing the overall agricultural impacts of the Northglenn project. During the agricultural productivity analysis an assessment was made of the effect of various water quality parameters on the various crops grown in the FRICO system. The impact of wastewater being used for irrigation purposes on crops, animal, and public health is also presented.

20. An economic analysis is presented in the final Environmental Impact Statement. This analysis does evaluate, in addition to agricultural economic impacts, changes in land economy as a consequence of loss of tax revenues and economic changes due to reduction in property values of land adjacent to the proposed treatment plant and storage reservoir. In the process of developing the economic analysis it was determined that existing input/output models were not available to adequately assess the complexities of the proposed project. Relative to the evaluation of land use changes data were insufficient to make any determination of the impact based on a frequency level of dry years. An analysis has been provided of alternative water supply sources other than the FRICO system.

PAGE REFERENCE

20 Sub-Task C.2 b

Modify this task to also reflect the impact to Northglenn with and without a FRICO water supply. (ie. other sources of water.)

21 (p.21) Task D - Public Health Impacts
The environmental assessment should also reflect the possible distribution of effluent reuse run-off waters in the Bull Canal system as they might affect the Towns of Firestone, Frederick and Dacono, including possible mitigation measures and associated costs. The public health impacts and future use of Bull Canal waters for public water supply should also include an assessment of the possibility of effluent in Bull Canal inadvertantly reentering the Lower Boulder Extension Ditch which is a potential public water supply currently being considered by the City of Fort Lupton.

An assessment of the existing quality of water in both the Bull Canal and Lower Boulder Extension Ditch should be prepared. It should reflect the suitability of existing waters for public water supply.

The general costs and limitations on improving these waters to meet drinking water standards for both the existing and projected situation should be prepared and analyzed.

21. As stated previously, public health impacts have been evaluated in detail. EPA did not feel it was within the scope of this project to determine the cost and limitations of improving the various affected waters in the project area as to their ability to meet drinking water standards.

(p.22) Task E - Analyze the Direct Impacts of the Wastewater Treatment Facility

Sub-Task E.1 - add the following language:
"Determine the potential for shallow and deep ground water quality changes..."

Sub-Task E.2
Include comment on p.3 #4 previously discussed.

22 Add the following new sub-tasks following E.5:
• Sub-Task E.6 Evaluate the adequacy of the proposed reuse system in meeting criteria for "alternate or innovative waste treatment technology" in the context of current EPA guidance and regulations, and State of Colorado Water Quality Control Commission policy on water reuse, including recommendations of the July 20, 1977 "Report of the Task Force on the Land Application Treatment of Waste Water to the Governor's Science and Technology Advisory Committee". Make a determination as to whether the project is considered eligible for EPA 201 Construction Grants monies and the level of EPA participation in funding.

22. EPA has reviewed and evaluated the Northglenn project in the context of its ability to meet alternative and innovative waste treatment technology. Additionally the Colorado Water Quality Control Commission's policy on water reuse has been taken into consideration in the determination of grant eligibility. Based on its total environmental and economic analysis of the system, EPA has determined that the Northglenn wastewater treatment element of its water resource management plan is eligible for construction grant monies. This analysis is presented in Chapter 6.

23 Sub-Task E.7 Determine flexibility of proposed system to meet an anticipated range of treatment requirements for BOD, SS; also nutrient levels, synthetic compounds, heavy metals, viruses. Examine feasibility of add-on treatment processes to proposed system for removal of problem pollutants in the event that NPDES permit conditions are changed for BOD, SS, and fecal coliform limits.

23. A comprehensive analysis of the wastewater treatment system has been prepared and is presented in Chapter 4. This analysis did consider the flexibility of the proposed system to meet the anticipated range of treatment requirements and also alternative methods for ensuring compliance with Northglenn's NPDES permit. However, additional add-on treatment processes were not considered as a feasible method of achieving NPDES permit conditions due to the excessive costs of such processes. Alternative mitigation measures have been considered and are presented in the EIS.

PAGE REFERENCE

24 Sub-Task E.8 Assess the need for, and recommend options for remedial action plans in event of system failure or inability to meet NPDES permit conditions or other limitations placed on effluent discharge.

25 Sub-Task E.9 Assess the need for continual short and long-term water quality monitoring at the lagoon site and through the Bull Canal system to protect public health (including potable water supply, agricultural use, secondary contact)."

Sub-Task E.10 (formerly Sub-Task E.6)

(p.23) Responsible Party:
It is assumed that the term "the consulting engineer" refers to the contractor responsible for completion of this Environmental Assessment.

26 Task F - Assessment of Cost-Effectiveness Analysis Between Alternatives (New Task)

The project should be reassessed for cost-effectiveness. This project should be evaluated against previously considered alternatives in light of the potential impacts identified in the environmental assessment. The analysis should reflect compliance with the most recent EPA guidance including PRM's and Federal Regulations on cost-effectiveness analysis for land application-reuse systems.

(EPA may wish to expand the scope of the proposed new task)

(p.23) Task G - Recommendations (formely Task F)
Sub-Task F.1
Add "6. economic impacts" to the non-inclusive list.

27 Sub-Task F.2
Change language to read:
"Need for changes in project. If adverse impacts are documented in Tasks C, D, E, F, then recommendations for project modifications through location, design, operation characteristics, monitoring or development of new project alternatives will be made.

28 Sub-Task F.4 Recommendations for the substance of intergovernmental agreements - the duly adopted Larimer-Weld 208 Water Quality Management Plan requires that entities constructing, operating and maintaining waste treatment facilities within its planning boundaries will negotiate intergovernmental agreements to define the relationship between these operations functions and water quality management functions by designated management agencies approval by EPA and the State of Colorado. Recommendations for the general substance of an intergovernmental

24. Plans in the event of system failure or a violation of the NPDES permit conditions and other limitations placed on effluent discharges, are discussed in the final Environmental Impact Statement. Such plans include various operational controls to reduce algal blooms if they occur.

25. As part of the grant conditions Northglenn is required to implement a water quality monitoring program of surface waters and goundwaters adjacent to the treatment/storage site of the Bull Canal and other waters impacted by the effluent. This monitoring program is presented in the final Environmental Impact Statement in Chapter 5.

26. An extensive cost effective analysis of the alternatives for wastewater treatment has been developed by EPA using the multi-purpose cost analysis process. This analysis is presented in the final Environmental Impact Statement. The two wastewater treatment alternative systems include the Denver Metro Plant using Northglenn's pro-rata share of the costs and the proposed Northglenn wastewater treatment facility.

27. EPA believes it has documented all significant adverse impacts associated with the Northglenn Water Resource Management Plan. Chapter 5 presents proposed and accepted mitigation measures to eliminate the identified adverse impacts.

28. This evaluation and analysis is presented in the draft Environmental Impact Statement.

agreement between the City of Northglenn as an operations agency and Weld County as a management agency will be made.

Sub-Task F.5 (formerly Sub-Task F.4)

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*The Larimer-Weld Regional Council of Governments reserves the right to provide additional comments to EPA on the "Directive of Work" and to comment on subsequent Scopes of Work prepared for consultant activities.

5/25/79 - revision 5/29/79

SUB-COMMITTEE TO REVIEW NORTHGLENN WATER MANAGEMENT PROJECT

Northern Colorado Water Conservancy District Offices
May 21, 1979
7:00 p.m.

W. D. Farr, Sr., Chairman	Chairman, Larimer-Weld 208 APC
Darryl Alleman	Utilities Director, City of Greeley
Curt Miller	Senior Staff Engineer - City of Fort Collins
Henry P. Caulfield	Fort Collins Greenbelt Association
Martelle Nussbaumer	Fort Collins - League of Women Voters
Leo Berger	Farmer, Weld County and representative of National Association of Soil Conservation Districts
Dwight Holter	Attorney, Kodak of Colorado
Richard Beaver	Chemist, Colorado State University
Irma Princic	Chairwoman, LWRCOG
Staff	
Larry Pearson	Director of Comprehensive Planning LWRCOG
Terrence L. Trembly	208 Project Manager, LWRCOG
Gary Fortner	Planning Director, Weld County

Géisé

Francis K. Culkin
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720 So. Colorado Blvd.
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February 29, 1980

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MAR 04 1980
EPA REGION VIII
Water Division

Mr. Roger Williams
Regional Administrator
U. S. Environmental
  Protection Agency
1860 Lincoln Street
Denver, Colorado 80203

Dear Mr. Williams:

This letter, written on behalf of my clients, The Town of Frederick, The City of Fort Lupton and the Weisner Sub-Division Preservation Association, is to provide you with our comments regarding the Draft Environmental Impact Statement of Northglenn Water Management Plan. Although the period for public comment has expired, Mr. Wes Wilson, Project Officer, kindly extended to me an additional five days within which to submit these comments.

1 My clients believe that the initial procedures surrounding the issuance of the draft EIS were inadequate and contrary to the regulations of the Council of Environmental Quality, which are binding on every federal agency, including the Environmental Protection Agency. As you are well aware, these regulations require that following a Notice of Intent to Prepare and Environmental Impact Statement, a "scoping" proceeding is to be held to allow public comment on the areas to be addressed in a draft EIS. This procedure was not followed in the present matter; the Notice of Intent to Prepare an EIS was issued simultanecusly with the prepared "draft," this draft being nothing more than the Environmental Assessment issued in November with a new cover and a suggested decision.

The CEQ regulations clearly indicate that a draft EIS "shall be prepared in accordance with the scope decided upon in the scoping process." (40 C.F.R. 1502.9(a)). This language makes it clear that a draft EIS is not to be issued until the "scoping process" has been completed. My clients and other interested persons were at no time notified of a scoping process and in particular, that such a process would be undertaken in such an irregular manner, if it took place at all.

Orig: BW
cy: RA, DEA, MD, RC

RESPONSE: 1. The issue of compliance with the scoping process was subject to litigation in Consolidated Ditches Company, et.al. vs. EPA. The issue was settled by mutual written agreement between EPA and these parties on June 2, 1980. It is EPA's position that during the last two years of review by our agency; the environmental assessment, public meetings and numerous phone calls regarding the Northglenn proposal were sufficient to satisfy the intent and purpose of the public scoping process required under recent regulations promulgated by the Council on Environmental Quality.

1 My clients have not been afforded the time to prepare comments on the "draft EIS" as contemplated by the CEQ regulations in that no adequate or regular scoping process was carried out to determine the particular areas of concern to be addressed by a draft statement.

In addition to the irregularities and inadequacies that surround the present matter with regard to required Agency procedures, numerous other concerns regarding the "draft EIS" have been expressed by my clients. In our opinion, these concerns need to be resolved by the EPA, rather than merely addressed by an EIS.

2 The comments received at the 13 February 1980 Public Hearing on the Northglenn Project indicate that a vast array of concerns continue to trouble those who will be affected by the project should it be completed. The Director for Utilities for the City of Thornton, Mr. Palmer, expressed his opinion that the project is unnecessary, that Thornton can adequately supply Northglenn with its water requirements, and that the water from Thornton is sold at the same price to Northglenn as it is to its own residents. Mr. Palmer's comments illustrate the point that little investigation has been made of alternative systems.

The CEQ regulations clearly provide that a draft EIS "should present the environmental impacts of the proposal and the alternatives in comparative form" in order to provide a clear basis for choice among options. (40 C.F.R. 1502.14). This regulation also mandates an Agency to "rigorously explore and objectively evaluate all reasonable alternatives" and to "devote substantial treatment to each alternative considered in detail including the proposed action."

Other alternatives to Northglenn's proposed exchange program with FRICO have not been adequately addressed by the "draft EIS" and consequently no informed recommendations concerning possible alternatives were made.

3 My clients have some particular concerns which deserve special comment. The "draft EIS" states that... "the frequency of any odor problems for residences near the proposed lagoons will be small." However, much of the information upon which this statement is based was gleaned from the Northglenn engineer only. My clients, particularly the Weisner Sub-Division, believe that an independent study should be undertaken in this case.

4 Further, the draft notes that, with regard to drinking water supply, the EPA "recommends that Frederick explore other options to satisfy future water supply demands" because present potential water supplies are now classified solely for agricultural use. My clients do not believe that this issue has been fully addressed

2. EPA presents in the final Environmental Impact Statement a rigorous and objective evaluation of all reasonable alternatives both for water supply and wastewater treatment for Northglenn needs. This analysis is presented in the alternative evaluation section of the final Environmental Impact Statement. Extensive consideration is given to water supply alternatives which do not involve the exchange programs.

3. EPA has conducted an independent analysis of the potential for odor generation at the lagoons and reservoir. EPA recognizes that there is considerable difficulty in identifying the events necessary to create an odor episode and to further provide mitigation measures for any individual event. EPA believes that there is a likelihood of an odor event occurring at the treatment site as a consequence of the facilitiy's inability to meet proposed suspended solids requirements. The circumstances surrounding such an event would be associated with large algae blooms in the reservoir which during decomposition could result in the generation of odors. The actual odor event itself and its frequency cannot be determined at this time and mitigation measures to control algae production as part of the operational features of the proposed plan will in effect be mitigation measures for odor episodes.

4. Refer to response to comment Number 1 to the Town of Dacono letter dated February 18, 1980.

EPA concludes that since the Canal is not presently used for a domestic water supply, nor has there been any formal request to designate the Canal for domestic water supply, there is no need to protect the Canal for water supply.

4 by the EPA, and that, although the water supply is presently classified for agricultural use, Frederick should not be forever foreclosed from pursuing the most viable water supply it has until the area is fully explored.

5 In addition, the draft states that "data to calculate the increased nitrate concentration in Sand Hill Lake are currently not available." My clients, Fort Lupton in particular, are concerned with potential nitrate levels and believe that further study in this area is warranted.

6 According to the draft, residential property values in the area of the proposed plant will decrease by at least five percent. This may appear to be a minimal amount, but to my clients who reside in close proximity to the proposed site, five percent is certainly more than minimal, particularly in a time of rising home costs. My clients believe that the issue of devalued property should be more fully explored.

7 My clients and I are aware, as the draft confirms, that Northglenn may build the proposed plant whether or not federal funds are granted. Such an action is contrary to CEQ regulations which indicate that no action shall be undertaken, except for plans and design, that will "have an adverse impact" or "limit the choice of reasonable alternatives." (40 C.F.R. 1506.1(a) (1) (2)). If such adverse action is taken before the Agency's NEPA process is complete, the Agency is obligated to notify the applicant that the Agency will take "appropriate action to insure that the objectives and purposes of NEPA are achieved." (40 C.F.R. 1506.1(b)). It is clear that any encouragement by the EPA to Northglenn regarding commencement of the project is contrary to the CEQ regulations, particularly when alternatives remain to be investigated.

8 Although my clients expect to make further comments when an adequate draft, preceeded by the required "scoping process," is completed, we would request at this time the following action from the EPA:

1. That a scoping process as required by CEQ regulations be instituted.

2. That a draft EIS by prepared based upon this scoping proceeding and such other information as is necessary to prepare such a draft.

3. That Northglenn be informed that any construction of the project before the NEPA process is completed is contrary to CEQ regulations.

5. EPA does not believe that any further analysis of nitrate concentrations in Sand Hill Lake would prove meaningful at this time. This is because sources of nitrate contributions to Sand Hill Lake cannot be effectively segregated. The primary water supply source to Sand Hill Lake is Boulder Creek and irrigation return flows with some infrequent discharges from the Bull Canal terminal reservoir. The intermittent contribution of water into this system from the Bull Canal has an insignificant effect on nitrate concentration.

6. EPA acknowledges that property values in the area adjacent to Northglenn's wastewater treatment plant may decrease in value as indicated in the response to Northglenn's letter, comment Number 9. EPA further recognizes that decreases in adjacent land values will vary from area to area. These changes in value are in fact largely a result of public perception and acceptance of the facility. EPA does not feel that further analysis of this issue is necessary at this time.

7. EPA is aware of all appropriate CEQ regulations as they apply to the Northglenn project. Further EPA has not encouraged Northglenn to commence with the project until the Environmental Impact Statement has been completed. Additional alternative analyses have been prepared for the final Environmental Impact Statement.

8. See response to Item 1.

A draft EIS has been prepared and distributed for comment. A public hearing has been held on that draft Environmental Impact Statement. A final Environmental Impact Statement has been prepared and submitted for review. A final public hearing will be held on the final Environmental Impact Statement.

My clients are anxious to see that, through proper Agency action, the concerns expressed here are resolved. We are willing to cooperate with you as fully as possible in bringing this matter to a satisfactory conclusion.

Sincerely,

FRANCIS K. CULKIN

FKC/bja

My name is Albert Watada and I represent the Consolidated Ditches, consisting of 12 ditchs, which irrigates over 60,000 acres along the South Platt River.

This onization was incorporated on 12th day of March, 1902.

The five executive board members consist of Delbert Shable, George Steiber, Antone Heit, Elton Miller and myself.

Of the five men board four of us are in third generation farming and one in second generation. Therefore each one of us has deep roots along the South Platt River. We have pride of our long heritage in the soil that brings food to your table. At this time we feel the comments on your impact statement is not all correct, and we will not accept your comments with creditability.

(1) CHAPTER 4, page 56 of evaluation & alternatives.

1 Nitrogen on sugar beets; management of water application to sugar beets will be necessary to satisfy Great Westerns contrectual agreement. Also, the comment on high nitrate in silage. I do hope your not telling us farmers how to make money. I would like to point to you optimum yield in any crop generally means better chance for profit. This means timely application of balance fertilizer and not by management of water as stated on page 56. The remarks that is made on this page has puzzled a farmer like myself, we pay high fee in hiring consultant and have put in many years of hard and costly experience in farming, and we open this book on page 56 Mr. Wilson of E P A suggest management of water application is key to our fertilizer application. I call this "over educated remark".

(2) ~~According to~~ Agricultural Land Conversion in Colorado:

The conversion of agricultural land to nonagricultural uses is receiving increased attention throughout the nation and world, from scientists, farmers, government officials, and other

RESPONSE:

1. EPA acknowledges the views of Mr. Albert Watada and appreciates his input into the preparation of the final Environmental Impact Statement.

concerned citizens. "Agricultural land conversion is a serious
problem in Colorado". The bulk of our farmland and cropland
losses have occurred along the Front Range where 80 percent of
the state's population is located.

Forty percent of all Colorado agricultural production takes
place along the front range. Weld County alone accounts for
30 percent of the state's agricultural sales. Weld County's
total agricultural sales of over 600 million $ placed third
amoung all counties in the nation and bulk of that comes from
farm along the South Platt. 1/3 of this is exported to help
the balance of trade. We need this balance of trade in order
to help our energy problem until this nation can be independent
of the fuel problems. What other commodities can match this? We
1 will not be able to accomplish this with alternatives that is
suggested to us farmers, by E P A. In addition to the cost in
loss of food production, the Front Range stands to lose very
important environmental benefits if agricultural water conversion
continues unabated. Agricultural land provides open space for
maintaining air quality, wild life habitat and uncluttered
visual lines—benefits which will become increasingly important
as population growth continues. This cannot continue if the
pattern of taking prime agricultural land out of production.
After all the benefit of clean air is provided by agricultural
land at no cost to the municipalities.
In the end the issue will not only be of taxpayer and consumer
of Northglenn but a problem of agricultural issue and of the
nation. This is environmental and agricultural impact.

Summary of Draft EIS Public Hearing Record
February 13, 1980
Northglenn Community Center

EPA Hearing Officer - Mr. Fred Huff
Multi-Regional Council

Co-Hearing Officer - Mr. Tom Speicher
Regional Council's Office

Project Officer - Mr. Weston Wilson
Water Division

Summary of Oral Testimony

The following is a summary provided by EPA of each presentation. The complete transcript of these proceedings is available for public review in the EPA Library at 1860 Lincoln St., Denver, Colorado, between the hours of 8:30 am and 4:00 pm, Monday thru Friday.

1) Adolph Bohlander, President, Farmers Reservoir and Irrigation Co.
(See letter dated February 21, 1980.)

Mr. Bohlander does not agree that the water will not be suitable for raw edible vegetables. FRICO has been using water similar and not as highly treated from the South Platte River and has grown all crops without restrictions and have had no ill effects. If water quality is so bad and FRICO can't use it, FRICO may not loan the water to Northglenn.

2) Dave Pampau, Deputy Executive Director of the Denver Regional Council of Governments
(See letter dated February 25, 1980.)

DRCOG generally supports the Northglenn proposal.

3) Charles Sabodos, Town of Dacono
(See letter dated February 18, 1980 from Mayor Elliott.)

The Town of Dacono emphatically rejects disinfection of their water supply. Raises questions on odors in Dacono's reservoir.

4) Sherman Lyon, Town Board of Firestone
(See letter dated February 13, 1980 from Mayor Becker.)

The need for the facility has not been definitely proven. The proposed holding ponds (tailwater control ponds) are inadequate and need to be extended to protect all of section 19. Nitrate pollution of the Bull Canal is contrary to mandate set by Congress for EPA. In light of these questions, Firestone strongly opposes the construction of the Northglenn facility.

5) Cary Palmer, Director of Utilities for the City of Thornton
(See letter dated January 31, 1980 from Mayor Carpenter.)

Read letter of January 31, 1980, then read letter of November 26, 1979 from Wes Brown, Chairman, Thornton Utilities Board to Mayor-elect Barry provided as attachment to comments by Larimer-Weld COG (see COG letter of February 25, 1980).

Read resolution passed by City of Thornton on February 11, 1980 (see attachment to Larimer-Weld COG letter of February 25, 1980).

Additional issues: After Thornton discovered there was a problem with nitrates in their water supply, they corrected it. This problem was discovered after Northglenn decided they wanted their own utility system. It is difficult to understand how this could be a major reason for Northglenn to go off of Thornton's system.

6) Pamela Mulhall, Assistant to the Director of Public Works, City of Westminster
(See letter of February 11, 1980 from Mayor June.)

Generally supports Northglenn's plan.

7) Greg Hobbs, Attorney, Davis, Graham and Stubbs, representing Consolidated Ditches and Rocky Mountain Fuel Company
(See letter dated February 13, 1980.)

Indicates that project will adversely affect front range agriculture. Why not provide further development of Colorado River water? The proposal is not very innovative as Consolidated Ditch has been reusing effluent for years. Called upon EPA to objectively study the alternatives of either obtaining water from Denver, continuing with Thornton, or developing west slope alternatives. Wants to see "status quo" retained as much as possible. Condemnation is a strawman and would not happen because it is not politically viable. Condemnation was simply set up to propel project.

Discusses lack of scoping process and failure to include water supply alternatives.

Requests EPA to come out with a decision that says that no action alternative is the alternative that is best for Northglenn and for those that must live with Northglenn.

Submitted two volume deposition of Mr. Richard Lundahl for the City of Northglenn wherein Mr. Hobbs indicates that Mr. Lundahl indicated the City had not explored alternatives to a water supply. Distressed to find out that Northglenn had already started construction of Standley Lake pipeline and water treatment plant.

8) Mr. Gerald R. Armstrong, President, Rocky Mountain Fuel Co. (RMFCo)
(See two letters dated January 17, 1980.)

RMFCo owns 1760 acres in Southern Weld County and 72.17 shares of the Standley Division of FRICO. Indicates how valuable crop production is on his company's property. They are the largest non-municipal stockholder in FRICO.

Seeks to protect the quality of water his company is entitled to. There are shareholders who have never consented to the proposal and RMFCo has stated their refusal to consent to the exchange proposal. The Advisory Panel process was a sham. As a panelist, information was denied him. The use of the Freedom of Information Act was necessary to get some information. EPA staff was prejudiced in favor of Northglenn's proposal.

Discusses letter of January 17, 1980 to EPA regarding location of proposed tailwater ponds on RMFCo property. Current appraisal of his company's land in Frederick is $4000/acre. Should Northglenn Project be approved, it could drop to $800/acre. How does EPA justify devaluating somebody's land?

Issue of project on coal mining was not addressed in EIS. Cutting county tax base, getting cities in to agriculture business and affecting the quality of life should not be done.

9) Albert Watada representing Consolidated Ditches
(See undated written statement located at the end of written comments
section.)

10) Raymond Hogan, water resources engineer with W.W. Wheeler and Associates, Inc. representing Consolidated Ditches
(See statement dated February 20, 1980.)

11) Mr. Thomas G. Sanders, Professor Sanitary Engineering, Colorado State University

1 Indicates expertise of person doing the EIS lack education in areas of public health and sanitary engineering. Regarding high nitrate concentration in Bull Canal after project completion, Mr. Sanders says while that makes its use for drinking water expensive it should not be considered a viable source for drinking water because the source is sewage effluent. There is potential to transmit man's viruses. Makes comparison with problems in Egypt due to sewage in irrigation ditches and his recommendation while consulting there was to get sewage out of irrigation ditches. Suggests western slope and Thornton supplied options be considered. Does not feel that limit of 200 fecal count per 100 ml is sufficient for this type of system, particularly because this system will set precedents. Would rather see stricter standards similar to the State of California (i.e. around 2 total coliform counts per 100 ml). Colorado has a problem and needs to set a standard in this regard.

RESPONSE: 1. EPA concurs with Dr. Sanders assessment that drinking water supplies should not be permitted with wastewater which has received secondary levels of treatment. Currently the Bull Canal is not designated as a water supply source by the Water Quality Control Commission. EPA concludes that since the Canal is not presently used for a domestic water supply, nor has there been any formal request to designate the Canal for domestic water supply, there is no need to protect the Canal for water supply. In reference to evaluation of West Slope and Thronton water supply alternatives, an evaluation of these options is presented in Chapter 3. With regard to the 200 per 100 milliliter fecal coliform requirement, EPA believes that sufficient protection to public health is provided with this discharge requirement on Northglenn's wastewater effluent. This decision is based on expert evaluation of Northglenn's treatment system and storage reservoir and the ability of this system to significantly reduce pathogenic organisms. EPA further believes that data are insufficient at this time to impose stricter standards similar to the State of California. EPA will in the future be establishing criteria for systems similar to the Northglenn water reuse management plan and be presenting these criteria to the Colorado Water Quality Control Commission for consideration of incorporation into the state's water quality standards.

1 Suggests that rather than trying to answer question of whether the plan will receive water court approval, that all possible court decisions be reviewed and what effects they may have on plan. Supports proposed review of treatment process and possible additions to the treatment process, as he does not believe the effluent quality will meet the 30/30 BOD and suspended solids requirement. Suggests study of additional filtration and coagulation.

Suggests intensive investigation of energy needs and comparison to more conventional treatment systems. Suggests an analysis of the plant operational plan. Suggests research on impacts of use of effluent on agricultural soils. Might productivity decrease due to change in clay soil matrix? Sludge plan and options should be addressed. What would Colorado's response be if Northglenn funds project without EPA grant? State does have authority through NPDES requirements to take EPA proposed conditions and force it on the permit process. There is a problem with a lack of resources and manpower within the Colorado Health Department to control and efficiently operate such facilities as this.

Requests that EPA and State develop comprehensive water quality criteria standards and guidelines associated with the reuse of sewage.

12) Mr. Bill Schuler, Rocky Mountain Consultants representing the Town of Frederick
(Read letter of February 12, 1980 from Mayor Hall.)

13) Mr. Ed D'Orazio, resident of Frederick, Colorado
Read statement by Mr. Joseph D'Orazio.
(See undated written comments at end of comments section.)

14) Mr. Gary Miller, Thornton High School student

2 Is conducting a science project dealing with the ecology of Grange Hall Creek. EIS contains very little on impacts and costs of the proposed Stonehocker Reservoir. Wants to know what precautions are being taken to preserve the stream environment during and after such construction.

15) Mr. Harold Hodges, resident of the City of Northglenn

3 Same questions are asked over and over again as in previous Northglenn hearings. Is Northglenn to become the "snaildarter" of the West? Same people who cried over the issue of the snaildarter are using the same tactics to defeat the most progressive water resource program in the nation. This is a turf issue, your neighborhood versus my neighborhood, rather than looking at it as beneficial to both Weld County and Adams County. Agrees with concerns on crops and reuse issues. EPA never addresses issue that Clear Creek has mine dumps and sewage in it and is not pure water. Maybe it is time for Northglenn to go alone. EPA has sufficient information now to make decision. Does not understand why the exchange agreement between two private parties can come under the auspices of the EPA statement.

RESPONSE: 2. At this point in time in the development of Northglenn's water resource management plan, Northglenn has made the determination not to proceed with the proposed Stonehocker Reservoir. If at some point in time this reservoir becomes integrated into the overall plan, Northglenn will be required to acquire a Corps of Engineers 404 permit. At such time EPA will review the 404 permit for the Stonehocker Reservoir and make a determination of the impacts associated with the reservoir. Therefore, it is not within this EIS to assess the impacts associated with the proposed reservoir.

RESPONSE: 3. The intention of the Environmental Impact Statement on Northglenn Water Resource Management Plan is not to create an aura similar to that of the snail darter that was associated with the proposed Teleco Dam project. The intent is to provide a full disclosure of the Northglenn plan and its impacts and measures necessary to mitigate the identified significant adverse impacts. Through this process the views and opinions of the various vested interest groups associated with the project are evaluated. Both pros and cons for the project are presented, considered and evaluated in EPA's decision making process. EPA does not agree that this is a turf issue, but rather it is an innovative technology which has come under the scrutiny of various public and private interest groups. EPA does not believe that it is in the purview of their Environmental Impact Statement to evaluate the various water quality problems associated with Clear Creek. Furthermore, EPA makes its decision as to Northglenn's grant eligibility after adequate detailed information is presented to the public and comments are received and technical evaluations are made. EPA must consider the FRICO-Northglenn water exchange program as part of its review of Northglenn's total water resource management plan because it plays a key integral part in the development, operation and implementation of Northglenn's plan.

If Denver Metro permit allows 1000 fecal per 100 ml, why not same standard for Northglenn? Doesn't think crop restriction is necessary as there are no heavy metal sources from Northglenn. Requests that methodology or formula for indicating there may be a five percent reduction in property values be stated. What does leap frog development pattern do to the agricultural values?

16) Levi F. Siebert, resident Weisner Subdivision

4 Would like answers regarding the five percent property devaluation. Appraisal on his home was $160,000 in February 1979, down to $134,000 by February 1980. The latter appraisal included the suggestion that he could never sell it for that because of the proposed sewage treatment facility.

17) Phillip J. Hatch, Program Manager for Environmental Affairs for the Great Western Sugar Company
(See written statement dated February 13, 1980.)

18) Thomas D. Faux, resident of Weisner Subdivision

5 Concerned about change in real estate values. Suggests reference to Boulder example that reason land value remained high near their treatment facility is due to green belt policy and land around the treatment plant may be the only thing available. Indicated he had 116 signatures from people stating that they are unhappy with the odors produced by the Louisville sewage plant. Signature list turned into Weld County Planning Commission. Also concerned about possible well contamination.

19). Frank Culkin, attorney representing the Weisner Subdivision, the Town of Fort Lupton and the Town of Frederick
(See letter of February 29, 1980.)

Believes that those opposing project have presented their case and EPA will act to deny funding to Northglenn.

20) Barry Keene, resident of Frederick

6 The EIS document is not entirely credible. For instance, the Larimer-Weld 208 Clean Water Plan does not designate any of the uses of the canals, so the EIS is incorrect to indicate the canal is designated solely for agriculture. Not realistic to restrict raw edible crops. May be done initially but what about 40 to 50 years from now? Suggests that arbitration for intergovernmental agreement should be defined.

21) Jim McNelly, operates the Planet Earthworm Company

7 Since 1977 has been taking grass clippings and recycling (earthworn castings) back to city. Stresses need to find economic ways to recycle nutrients and provide for organic agriculture. Regrets that Denver Metro sludge is only dumped at Lowry. Hopes people will not be prejudiced but rather look at long term benefits.

RESPONSE: 4. EPA has made the determination that no compensation will be provided to homeowners who might experience decrease in property value due to the location of Northglenn's wastewater treatment facility

RESPONSE: 5. See response to Levi Siebert above for EPA's response concerning real estate values. EPA acknowledges that odor generation from Northglenn's wastewater treatment facility may occur on occasion due to high algal concentrations in the storage reservoir. Mitigation measures to control algae will aid in controlling odor problems, however, it must be recognized that no wastewater treatment facility can be guaranteed to be 100 percent odor free. EPA would appreciate receiving the signatures of those individuals who have been unhappy with the odors produced by the Louisville Sewage Treatment Plant for inclusion in the record. EPA believes that Northglenn's proposed construction techniques provide sufficient protection to prevent well contamination within the immediate vicinity of the wastewater treatment plant and storage reservoir.

RESPONSE: 6. EPA acknowledges that the Bull Canal is not specifically designated for agricultural use. However, that the primary use currently of the Bull Canal is for irrigation of agricultural lands. Concerning the restriction to raw edible crops, EPA has dropped this requirement for the Northglenn facility. This is a consequence of Northglenn agreeing to a 200 per 100 milliliter standard for their wastewater effluent. This standard has been written into the Northglenn discharge permit by the Colorado Department of Health. Therefore, EPA does not believe that excessively high health risks are associated with the wastewater effluent used for the irrigation of raw edible food crops. Concerning arbitration for the inter governmental agreement, EPA is considering appointing a negotiator between Weld County and Northglenn to arbitrate the conclusion of an acceptable intergovernmental agreement between the two parties.

RESPONSE: 7. EPA acknowledges the comments of the Planet Earth Worm Company and the support it presents for Northglenn's wastewater treatment and water resource management plan.

22) Thomas E. Norton, engineer for the City of Fort Lupton
(See letter dated February 22, 1980 by Mayor Hoffman.)

23) Terrence L. Trembly, Director of Water Quality Planning for Larimer-Weld Council of Governments
(See letter dated February 25, 1980 from Jonathan Rutstein.)

24) Edward Quinlan, President of the Weisner Preservation Association

8 Suggest that estimate of seepage (at the reservoir) of 55 acre/feet per year may be significant. Concerned about possible well pollution. Why can't there be a determination about whether the design considered possible damage from ice or earthquake generated waves? Will water table rise as a result of this facility? Could the Weisner Subdivision or other areas all of a sudden find the area has been designated a floodplain? We were there first. Why should Northglenn dump its problems in our laps. There are far too many "maybe", "could be" and "should be" statements in the EIS. EPA should provide definite answers.

25) Dr. Robert McGregor, consulting engineer with the firm of Schaefer and Roland, consultants to the City of Northglenn
(See letter dated February 25, 1980 from Richard P. Lundahl.)

9 EPA has done a thorough study and although he disagrees with some of the finer technical details, he thinks report's conclusions are well founded.

Suggests EPA analyze frequency of possible odor events. Indicates that 200 fecal counts per 100 ml standard is unnecessarily too restrictive as that standard is meant for primary contact recreational streams. Regarding raw edible crops, it should be pointed out that there are none (presently) grown under the FRICO systems. Suggests that local experience is sufficient to indicate there is no problem with use of secondary effluent on food crops. Cites very high fecal counts in Burlington Ditch and South Platte River. Requests that a standard for such reuse be defined. Indicates that cost estimates for Denver Metro fail to include Denver's new sludge project.

RESPONSE: 8. A seepage rate of water from the Bull Canal Reservoir of 55 acre feet per year does not indicate that this is a significant amount. This is primarily based on soil conditions at the reservoir which indicate that maximum absorption within the soil matrix below the reservoir amounts to two feet per year. Such circumstances along with Northglenn's lining of the Bull Canal Reservoir indicate to EPA that sufficient mitigation measures have been taken on the part of Northglenn to prevent possible groundwater and well contamination from the reservoir. Furthermore, Northglenn will establish a groundwater monitoring program which will further indicate if groundwater within the vicinity of the reservoir is being contaminated. If groundwater contamination is indicated from this monitoring, mitigation measures can be taken to prevent further contamination of wells in the vicinity. EPA's analysis of the Bull Canal reservoir construction and lining designs do indicate that the design has considered damage from ice or earthquake generated waves and that sufficient latitude is provided within the design to prevent damage from these events. Concerning water table rise as a result of the facility, EPA does not believe that the groundwater table will experience any increase due to the minimal amount of seepage and transmissivity at the site.

The Federal Emergency Management Agency indicates that such off-stream reservoirs do not create a flood risk if properly constructed and maintained, therefore, lending institutions would not be likely to require flood insurance for residences in the vicinity. Federally subsidized insurance would be available for homeowners in the area. Such insurance would be based on low hazard zone rates of approximately $20 to $25 annually per $100,000 insured value. In the absence of such insurance or a floodplain provision in the homeowner's policy, there would not be any coverage in the unlikely event of failure of the proposed Bull Canal Reservoir.

RESPONSE: 9. EPA believes that the Environmental Impact Statement provides a full disclosure of the impacts and necessary measures to mitigate these impacts associated with Northglenn's wastewater treatment facility.

EPA has determined that 200 fecal counts per 100 milliliter is an economically achievable standard for wastewater treatment facilities which involve agricultural reuse in unrestricted areas and is not as severe as other standards states have imposed for similar projects. This is further supported by the Colorado Water Quality Control Commission and Colorado Department of Health by writing Northglenn's wastewater treatment discharge permit to this standard. As stated previously Northglenn is not required to implement any type of control or restrictions on raw edible food crops provided that the 200 fecal coliform per 100 milliliter standard is achieved. EPA will establish a policy which addresses the public health risks associated with irrigation of 100 percent effluent for agricultural reuse in unrestricted areas. Concerning the inclusion of cost estimates for Denver Metro, EPA will not include Denver's new sludge project in the Denver Metro pro rata share for Northglenn as this facility is not sized differently without Northglenn.

City Hall
City of Thornton

8992 N. Washington Street
Thornton, Colorado 80229
303) 289 5801

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24667
EPA REGION VIII
CORRESPONDENCE CONTROL

May 1, 1980

Mr. Roger Williams, Administrator
Region VIII
U.S. Environmental Protection Agency
1860 Lincoln Street
Denver CO 80295

Dear Mr. Williams:

To assist in the preparation of the Environmental Impact Statement for Northglenn's sewage treatment plant, Thornton has been asked to present information on its ability to provide Northglenn with water and sewer service as one of the alternatives to the construction of Northglenn's project.

There has been a great deal of confusion regarding this subject. Obviously, we can serve Northglenn, and do not agree with contrary statements in the EIS. We are serving Northglenn today. In our planning for the future, however, both Northglenn and Thornton have mutually decided to discontinue this service.

Since the Severance Agreement between Thornton and Northglenn was signed last year, the City of Thornton has moved forward with its water and sewer development plans assuming that Northglenn would have an independent system. Thornton has spent considerable sums of money--as has Northglenn--carrying out the intent of the Severance Agreement and the 4-Way Agreement among Thornton, Northglenn, Westminster and the Farmers Reservoir and Irrigation Company, which also refers to the provision of utility services to Northglenn by Northglenn. We do not believe it is feasible or appropriate for Thornton to reassess its water resource development plan to include Northglenn at this late date.

Northglenn has not asked us to consider nor have we been planning for anything other than Northglenn severing completely from our system. In fact, we have been planning in anticipation of the severance in making available certain utility service to other areas pursuant to requests to us.

We do not want to get drawn into any disputes, if any, concerning Northglenn's desires to have their own system.

Sincerely yours,

Wes Brown

Wes Brown, Chairman
Thornton Utilities Board

Margaret Carpenter

Margaret Carpenter, Mayor

/kw

cc file

APPENDIX B

DESCRIPTION OF EXISTING ENVIRONMENT

APPENDIX B

DESCRIPTION OF THE EXISTING ENVIRONMENT

THE STUDY AREA

The proposed Northglenn plan affects a large geographical area north of the Denver metropolitan area. Included are the facilities for water supply, wastewater conveyance and treatment, urban stormwater collection, and augmentation elements of the various options. The key hydrologic features and political jurisdictions of concern in the Study Area are illustrated in Figure B-1.

COLORADO WATER RIGHTS AND ADMINISTRATION (1)

Colorado has a complex system of water administration and use. The system evolved from a mining and agriculturally based economy in which the demand for water often exceeded the supply. Because a major portion of the state's water is derived from melting snow high in the mountains, it is not distributed equally in either time or place.

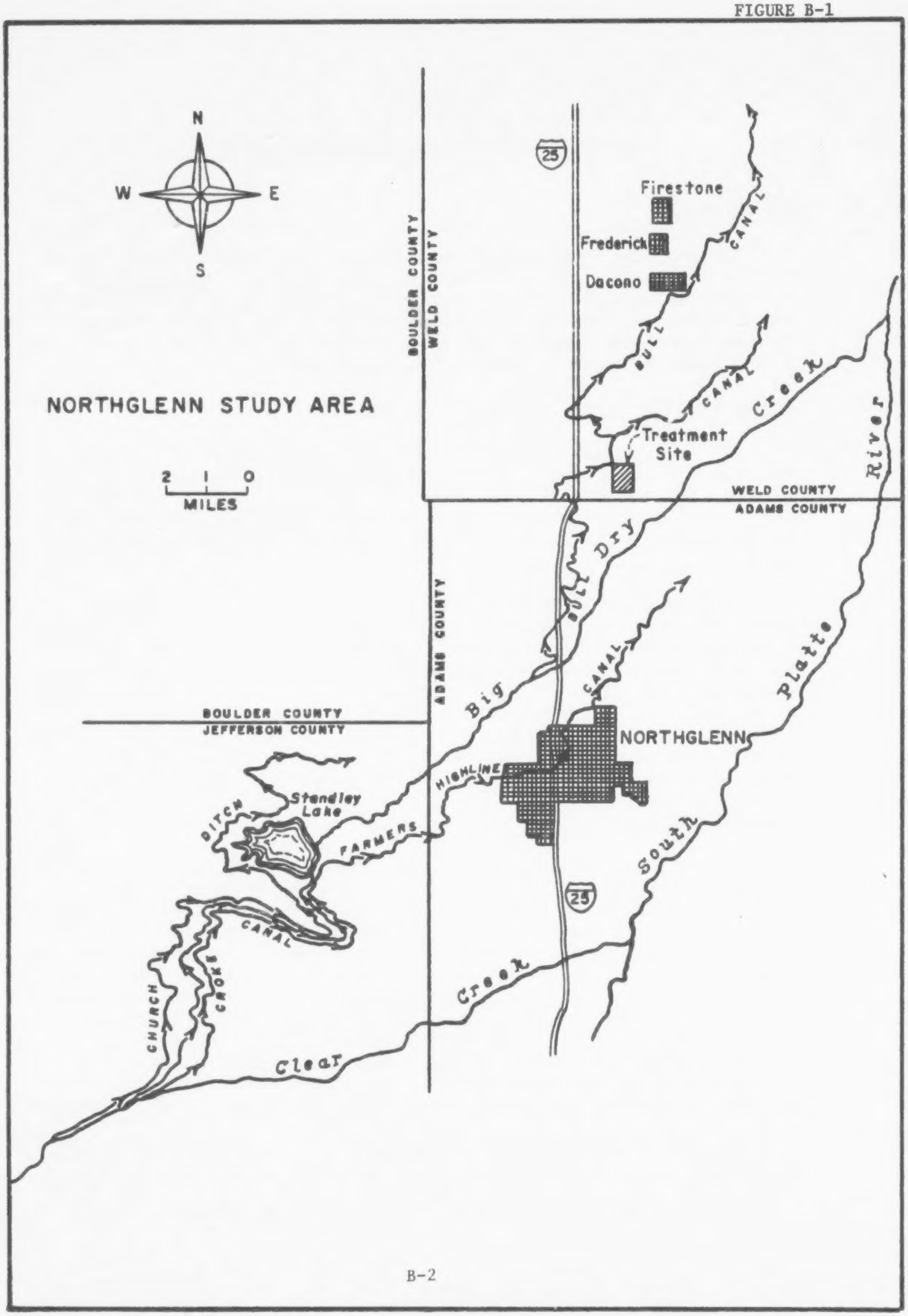
In Colorado, the use of surface water, including underground water tributary to the surface system, is administered by the State under the Appropriation Doctrine. The State Constitution protects the right of water users to appropriate the waters of natural streams according to a "first in time, first in right" doctrine, limited only by the amount of water physically available to those able to put it to beneficial use without waste. Colorado was admitted to the Union in 1876, and at that time officially declared the Appropriation Doctrine to be the sole basis for the allocation of state waters.

Administration

The responsibility for water administration and control in Colorado is divided between the State Engineer, under the Division of Water Resources of the State Department of Natural Resources, and the Water Court. The State Engineer has jurisdiction to administer, distribute, and regulate the waters of the State. The Water Court has jurisdiction over matters which are specified by statute to be heard by the water judges in the state district courts within their respective divisions. Matters decided by the Water Court include determination of amounts and priorities on applications for new water rights, and findings of diligence in the perfection of conditional water rights. Also, the responsibility of the Water Court is the determination of rights with respect to proposed changes of water rights and plans for augmentation.

Diversions are regulated on the basis of priorities decreed by the Courts, generally in the order in which the water was first appropriated and put to beneficial use. A water right with an early appropriation date takes precedence over rights with later dates. Court

FIGURE B-1



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NORTHGLENN STUDY AREA
2 1 0
MILES
BOULDER COUNTY
WELD COUNTY
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Firestone
Frederick
Dacono
BULL CANAL
Treatment Site
CANAL
Creek
Dry
Big
River
Platte
South
WELD COUNTY
ADAMS COUNTY
ADAMS COUNTY
WELD COUNTY
BULL
CANAL
NORTHGLENN
BOULDER COUNTY
JEFFERSON COUNTY
HIGHLINE
FARMERS
Standley Lake
DITCH
CANAL
CROKE
CHURCH
Clear
Creek
25

decrees also specify the permitted magnitude of diversion in terms of rate of flow for direct diversions and by volume for storage rights. A senior appropriator (i.e. one with an early date, whose right is not satisfied by the flow at his headgate) may call for water that is being diverted by a junior right upstream. This system of appropriation and administration thus determines the legal availability of water at a given location on a stream.

There are two categories of water rights which are defined by the time lag between diversion and use. Direct flow rights are for water diverted from the stream to a ditch and put to use more or less immediately. Storage rights are for water diverted from the flow of the stream and stored in a reservoir. This water is to be released for use at some later time, within the same year or in a subsequent year. Diversion for a storage right may be either for a reservoir off the stream channel from which it was diverted, or it may be for an on-channel reservoir.

The consumptive use of a crop is defined as the sum of two things; 1) transpiration, which is water entering crop roots and used to build tissue or is passed through the leaves of the crop into the atmosphere, or 2) evaporation, which is water evaporating from adjacent soil, water surfaces or from the surfaces of leaves of the crop (2). Because there is not enough rainfall to meet the water requirements of most crops in the Denver area, irrigation water from surface or groundwater supplies is needed to promote full crop growth and development.

Not all the water diverted is actually consumed in use, and the portion which returns to the stream and is available to downstream appropriators is known as return flow. The amount of consumptive use varies with the type of use and method of application. For irrigation, consumptive use ranges from 40 to 60 percent of diversions. Domestic and municipal consumptive use ranges from 5 to 40 percent while power generation and placer mining result in virtually no consumptive use.

Shallow ground water that is hydraulically connected to the surface system is defined as "tributary" water, and is also administered under the priority system. To protect the right of tributary wells to pump, it is necessary to adjudicate their priorities in the same manner as a surface appropriation.

Changes and Transfers

In Colorado, water rights are treated as real property and may be purchased or sold separately from the land to which they may be appurtenant. Water rights may be transferred from one location to another and the use to which the water is put in some cases may be changed. The principles governing such transfers and changes have been stated by the courts in Colorado, subject to certain conditions which relate primarily to protection of other appropriators from injury due to the change. Junior appropriators have vested rights in the continuation of stream conditions as they existed at the time of their respective appropriation. Mere ownership of a water right, however, does not mean that it is valuable and can be transferred or its use changed.

Augmentation Plans

The Water Right Determination and Administration Act of 1969 provides a means whereby complex water use projects and proposals can be reviewed by the court and a decree of approval granted. The technique is called a Plan for Augmentation and provides for legal recognition of total water supply systems. This proposal requires the application of the augmentation plan procedures in order to develop a reliable water supply for Northglenn's municipal use. In using water rights that have historically been used for irrigation to provide a municipal or industrial supply, special problems are sometimes encountered. These problems derive from the requirement that when a water right is changed there must be no injury to junior appropriators, and the fact that a municipal water supply is a year round use and must be highly dependable. To protect other appropriators on a stream, it is generally necessary to limit a change in use of a direct flow irrigation water right to the period of time that it was historically used beneficially. This means that it can provide water only during the irrigation season and not during the winter months. Water for winter use generally must be provided from reservoir storage by obtaining a new appropriation or by exchange. Storing a portion of the historic irrigation consumptive use during the time when it is legally available for later release to the stream to cover winter depletions is one method of exchange.

MEASUREMENT OF WATER

There are two types of units commonly used in this report to define water measurement. These are units of volume and units of discharge. The unit of volume commonly employed in irrigation practice is the acre-foot. An acre-foot is defined as the quantity of water required to cover one acre of land to a depth of one foot, or 43,560 cubic feet (3). There are 325,900 gallons in one acre-foot.

Discharge, or the rate of flow, is defined as the volume of water that passes a particular reference section in a unit of time. The units of discharge commonly used are gallons per minute (gpm) and cubic feet per second (cfs). One cfs is equivalent to 449 gpm.

The miners inch, or inch, was originally used in hydraulic mining and irrigation in the Western United States and is still commonly used in many areas. The use of this unit leads to confusion because the definition varies between states. In Colorado, one inch is the quantity of water which will flow through an orifice one inch square under a head of 5 inches. One Colorado inch is equal to about 12 gpm and 38.4 inches equals one cubic foot per second. Many ditch companies use the term "inch" to define the proportionate share of water in the ditch to which users are entitled. In this case the value of an inch varies with the amount of water actually in the ditch.

WATER RESOURCES IN THE STUDY AREA

Historically, the major use of water in the South Platte River Basin was by agriculture. While this is still the case, urbanization of the metro-Denver area and other areas throughout the region have taken lands out of crop production/agricultural use. As urbanization continues, additional lands will be taken out of production due to development pressures and the economic difficulties facing farmers in an urbanizing environment.

The South Platte River and its tributaries in the Denver area are fully appropriated. Water is available to junior appropriators only during periods of flood runoff. A new direct flow water right would not be a dependable or reliable source. Because the Denver metropolitan area continues to grow and water needs increase, it is necessary to look to various means to meet these new demands.

Storage is one method of increasing water availability through more efficient use of existing water supplies. Any new storage appropriation in the South Platte Basin will be junior to the proposed Narrows Project on the South Platte River in eastern Colorado, and the amount and frequency of water availability to the new facility would have to be carefully analyzed. In addition, there are many public and environmental concerns relating to storage which currently make other alternatives more desirable in terms of economic feasibility.

Transbasin water is another source of new water. This is an expensive means of water development, both in terms of facility construction and potential environmental impact on the basin of origin. Any new transbasin water project can be expected to take many years to develop.

A third water source is nontributary groundwater. Under current state administration policy, the amount of such water available for use depends upon the amount of land owned or controlled by the applicant. This concept is now being tested in court with the argument that nontributary ground water should be subject to the Appropriation Doctrine. Complete dependence on a nontributary ground water supply for a municipality is questionable, given the potential for limited useful life of the ground water aquifer.

The final source of water for municipal development is through acquisition of existing water rights and changing them to the new use. At the present time this is generally the easiest and most economical way to develop a water supply. Since agriculture uses about 95 percent of the water available in Colorado, it is a prime source for water acquisition. When agricultural water is acquired for a municipal system, the lands historically served are usually taken permanently out of production.

WATER SUPPLY SOURCES FOR NORTHGLENN

While the Northglenn plan incorporates some water from all of the sources mentioned previously, the biggest potential impact is on agriculture in the South Platte River Basin as it provides the most convenient and economical source of water for a municipal development. The significant feature of Northglenn's plan, however, is that a portion of the water used will be borrowed from agriculture, treated, and returned for agricultural use, thus mitigating at least some of the adverse impact to agriculture.

Northglenn's Water Sources

Northglenn's proposed raw water supply is based upon the yield from ownership or share ownership of water rights in the following:

a. The Standley Lake division of FRICO through direct ownership of shares;

b. The Standley Lake division of FRICO through the exchange proposal;

c. The Berthoud Pass Ditch, a transmountain ditch historically used as an irrigation supplement by FRICO;

d. Nontributary ground water beneath the City of Northglenn;

e. The Farmers Highline Canal historically used for agricultural irrigation in the area north of Clear Creek through share ownership in the Farmers Highline Canal and Reservoir Company; and

f. The Church Ditch also historically used for agricultural irrigation north of Clear Creek through share ownership in the Golden City and Ralston Creek Ditch Company.

A key feature of Northglenn's plan is the agreement with FRICO allowing Northglenn to borrow from Standley Lake the difference between their municipal water requirement and the amount of water Northglenn can provide under their own ownership. Any water so borrowed is returned with a 10 percent bonus to the Bull Canal users under the Standley Lake system for agricultural use. Northglenn has expressed their intention to continue irrigating those lands in FRICO they have purchased for water acquisition purposes subject to the availability of water. In a dry year, for example, all water would be needed by the City and there would be no excess water.

A description of the various raw water sources follows:

Standley Lake: The Standley Lake division is one of four main divisions of FRICO. The system serves a total area of slightly more than 15,000 acres and there are currently 2,373 outstanding shares of stock (2). As of August 1979 the cities of Westminster, Thornton and Northglenn owned or controlled 923 shares or 39 percent of the stock (4). The total capacity of Standley Lake is 42,000 acre-feet; however, FRICO has the use of only 20,000 acre-feet and, after the cities' share ownership is claimed as stipulated in the four-way agreement, there are only 12,220 acre-feet available for other shareholders. Due to the water acquisition policy of these cities, the shares owned by the cities are constantly increasing. The water rights associated with Standley Lake are listed below (5):

a. The Standley Reservoir in former Water District No. 2, for 940.36 acre-feet of water for irrigation purposes from Woman Creek with an appropriation date of September 1, 1869, decreed on August 2, 1918.

b. The Kinnear Ditch in former Water District No. 2, for 40.47 cubic feet of water per second for irrigation purposes from Woman Creek with an appropriation date of September 1, 1869, decreed on August 2, 1918.

c. The Kinnear Reservoir 1st Enlargement in former Water District No. 6, for 49,488 acre-feet of water for irrigation purposes from Coal Creek with an appropriation date of March 4, 1902, decreed on June 21, 1926.

d. The Croke Canal in former Water District No. 7, for 1056.00 cubic feet of water per second (conditional) for irrigation and domestic purposes from Clear Creek with an appropriation date of March 4, 1902, decreed on May 13, 1936.

e. The Croke Canal in former Water District No. 7, for 944.00 cubic feet of water per second for irrigation and domestic purposes from Clear Creek with an appropriation date of March 4, 1902, decreed on May 13, 1936.

f. The Standley Lake Reservoir in former Water District No. 7, for 32,361 acre-feet of water for irrigation and domestic purposes from Clear Creek with an appropriation date of March 4, 1902, decreed on May 13, 1936.

g. The Standley Lake Reservoir in former Water District No. 7, for 16,699 acre-feet of water (conditional) for irrigation and domestic purposes from Clear Creek with an appropriation date of March 4, 1902, decreed on May 13, 1936.

h. The Standley Reservoir Ditch in former Water District No. 6, for 26.47 cubic feet of water per second for irrigation purposes from Coal Creek with an appropriation date of May 20, 1872, decreed on June 2, 1882.

i. The Standley Reservoir in former Water District No. 6, for 940.00 acre-feet of water for irrigation purposes from Coal Creek with an appropriation date of September 1, 1869, decreed on December 19, 1900.

j. The Standley Lake Enlargement in former Water District No. 6, for 18,000 acre-feet of water (conditional-abandoned) for irrigation purposes from Coal Creek with an appropriation date of December 31, 1929, decreed on September 28, 1953.

k. The Berthoud Canal Tunnel in former Water District No. 51 (Division 5), for 53.40 cubic feet of water per second for irrigation purposes from the Fraser River with an appropriation date of June 30, 1902, decreed on August 3, 1911. The ditch generally operates between May and September.

Church Ditch: The Church Ditch (Golden Ralston Creek and Church Ditch Company) is a carrier ditch company whose physical facilities and water rights are primarily owned by FRICO (6). There are a total of 5,710.64 inches in the ditch of which Northglenn owns the right to purchase 415.205 inches of water. The source of supply is Clear Creek and the water rights are detailed in a copy of the Change of Water Rights Application in Appendix D. FRICO owns 29 percent of the total inches in the ditch and has in the past diverted water to Standley Lake when not required for operational purposes (6).

Farmers Highline Canal: The Farmers Highline Canal diverts from the north bank of Clear Creek. In addition, the ditch has rights in Big Dry Creek, Ralston Creek and Leyden Creek. The water rights are listed in a copy of a Change of Water Rights Application in Appendix D. Northglenn owns 7.7125 shares out of 1094 shares in the ditch. Northglenn can take the water into Standley Lake or can take it directly to the city for park irrigation.

Nontributary Ground Water: Northglenn has filed applications to construct deep wells for a total of 2300 acre-feet of nontributary ground water from the Laramie-Fox Hills and Arapahoe aquifers underlying the City. With the exception of Arapahoe Well No. 7, the State Engineer denied the permits. Under current water administration policy, the amount of water available from nontributary sources is based on surface land ownership, and Northglenn currently claims ownership or control of sufficient land to yield 650 acre-feet of water per year. It is Northglenn's position that it is not practical or economically feasible for any individual or group of individuals within the City to develop his own deep well supply and the full 2300 acre-feet per year underlying the City should be available to the City for development. The matter is currently pending with the Water Court.

REPLACEMENT WATER

Under terms of the agreement with FRICO, Northglenn must return the total amount of water borrowed for use of the City plus a 10 percent bonus. In addition, evaporation from the reservoir constructed to hold the water until released to the Bull Canal system must be included in the total replacement water requirement. The primary replacement water source will be treated wastewater from Northglenn. Included in the Northglenn replacement program is wastewater from an enclave of Thornton and all sewer line infiltration from the collection system.

A second source of replacement water is urban storm runoff in Grange Hall Creek which will be captured and diverted for treatment at the sewage plant. Northglenn has junior (1971) water rights for storm runoff from the city (7). The diversion will occur at a planned 30 acre-foot detention pond on Grange Hall Creek near the eastern edge of the City.

The third source of replacement water which may be required under certain dry year conditions is a planned well field located near the South Platte River, which will pump tributary water from the South Platte to a pumping station located near the Grange Hall Creek detention pond and to the Bull Canal Reservoir site. Northglenn plans a total of five wells to provide supplementary water for replacement purposes, but a specific site for the tributary well field has not yet been specified.

WATER QUALITY

Water Quality Criteria

The proposed Colorado stream water quality criteria (8) were used to assess the existing water quality. Criteria for water supply, recreation, and agriculture were used. The pertinent criteria for these uses are presented in Table B-1.

Surface waters suitable for a water supply are defined as follows:

> "Waters which after receiving approved disinfection such as simple chlorination or its equivalent or which after receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration and disinfection or its equivalent) will meet Colorado drinking water regulations and any revisions amendments, or supplements thereto." (8)

Recreational water is separated into Class I and Class II by the State of Colorado. These are defined as follows:

> Class I - "These surface waters are suitable or intended to become suitable for prolonged and intimate contact with the body or for recreational activities when the ingestion of small quantities of water is likely to occur. Such waters include but are not limited to those used for swimming." (8)

> Class II - "These surface waters are suitable for recreational uses on or about the water which are not included in the Class I category."

Agricultural waters are defined as:

> "These waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock."

TABLE B-1

WATER QUALITY PARAMETERS AND CRITERIA

		Use			
Category	Parameter	Water Supply	Recreation		Agriculture
			Class I	Class II	
Physical	Temperature, ^{o}C	-	-	-	-
	pH, units	5.0 - 9.0	6.5 - 9.0	-	-
	Dissolved Oxygen, mg/l	aerobic	aerobic	aerobic	aerobic
	Alkalinity, mg/l-$CaCO_3$	-	-	-	-
	Color	free from	free from	free from	free from
	Turbidity, TU	-	-	-	-
	TDS, mg/l	-	-	-	-
	TSS, mg/l	-	-	-	-
	TVS, mg/l	-	-	-	-
	Settleable solids, mg/l	-	-	-	-
	Hardness	-	-	-	-
	Conductivity, mmhos	-	-	-	-
Nutrients/ Organics	Phosphate, mg/l	-	-	-	-
	Phosphorus	-	-	-	-
	Ortho-phosphate, mg/l	-	-	-	-
	Nitrate-N, mg/l	10	-	-	100
	Nitrite-N, mg/l	1.0	-	-	10
	COD, mg/l	-	-	-	-
	BOD, mg/l	-	-	-	-
	Organic Nitrogen, mg/l	-	-	-	-
	TKN	-	-	-	-
Biological	Total Coliform, #/100 ml	-	-	-	-
	Fecal Coliform, #/100 ml	2000	200	2000	-
Toxics	Ammonia-N, mg/l	0.5	-	-	-
	Fluoride, mg/l*				
	Cyanide, mg/l	0.2	-	-	0.2
Metals	Aluminum, mg/l	-	-	-	-
	Arsenic, mg/l	0.05	-	-	0.1
	Cadmium, mg/l	0.01	-	-	0.01
	Chromium, mg/l	0.05	-	-	0.1
	Copper, mg/l	1.0	-	-	0.2
	Iron, mg/l (dissolved)	0.3	-	-	-
	Lead, mg/l	0.05	-	-	0.1
	Magnesium, mg/l	-	-	-	-
	Manganese, mg/l (dissolved)	0.05	-	-	0.2
	Molybdenum, mg/l	-	-	-	-
	Selenium, mg/l	0.01	-	-	0.02
	Zinc, mg/l	5.0	-	-	2.0
Inorganic Minerals	Chloride, mg/l	250	-	-	-
	Sodium, mg/l				
	Sulfate, mg/l	250	-	-	-
	Calcium, mg/l	-	-	-	-
	Boron, mg/l	-	-	-	0.75

*Fluoride levels vary based on annual average of the maximum daily air temperature.

Existing Water Quality

Water quality and quantity underlie the major issues of the Northglenn plan. The quality of water can effect both agricultural productivity and public health. Within the Northglenn-FRICO area quality data exist on several bodies of water. To facilitate the evaluation of these data the various waters have been segregated into two hydrologic systems. The Clear Creek system includes Clear Creek, the Church Canal, the Croke Canal, the Farmers Highline Canal, Allen Ditch, and Standley Lake. The Big Dry Creek system includes Big Dry Creek and the Bull Canal (see Figure B-2).

In order to effectively present the existing water quality data of the two systems, stream profiles are used. A profile is a graphic representation of a system with river miles as the horizontal axis and parameter concentration as the vertical axis. The principal rivers and canals are illustrated on each profile map. The profile maps are used to display mean and maximum/minimum values of each parameter at each station. The number of events comprising each sample set is also presented. Water quality profiles for nitrate and fecal coliform concentrations for the Clear Creek and Big Dry Creek systems are presented in Figures B-3 through B-6.

The utility of water quality data is dependent, in part, upon the number and frequency of samples that are collected. The data on Clear Creek are the most comprehensive, while the Bull Canal data are of questionable value since only one sample set is available for analysis.

The existing water quality data base is a compilation of in-situ parameter concentrations for 40 constituents measured at 22 stations. The existing water quality data base is summarized in Table B-2.

Physical Parameters

Water quality criteria are proposed for three of the twelve physical parameters/constituents that have been monitored. Of the three only pH has numeric criteria, 5.0-9.0 and 6.5-9.0 for water supply and Class I, recreation, respectively. The mean pH values reported in the Clear Creek system and the Big Dry Creek system range from 7.7 to 8.3, well within the criterion range.

Concentrations of color, turbidity, suspended solids, volatile solids, settleable solids, hardness, and conductivity in Clear Creek and Big Dry Creek appear to be influenced by wastewater discharges into these waters and possibly by seasonal variations.

Nutrients/Organics

A total of nine parameters in this category have been monitored. The water supply and agricultural criteria for nitrate are 10 mg/l and 100 mg/l, respectively. The nitrite criteria for water supply and

TABLE B-2

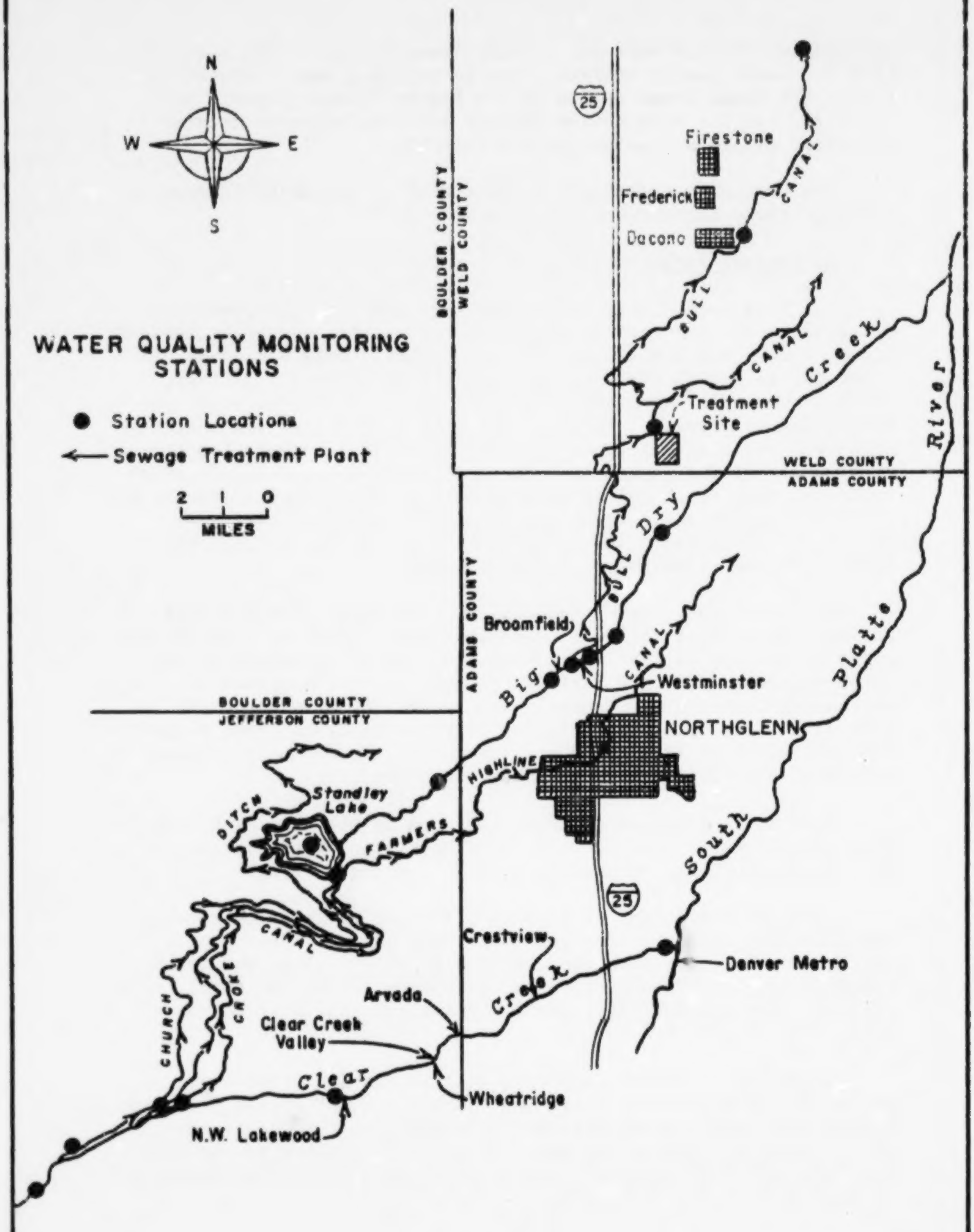
SUMMARY OF EXISTING WATER QUALITY

Parameter	CRITERIA				RANGE OF MEAN VALUES REPORTED							
	WS	Rec I	Rec II	Ag	Clear Cr.	Croke Cnl	Church Dtch	Farmers Hghln	Allen Dtch	Standley Lake	Big Dry Cr	Bull Canal
Temperature, °C	-	-	-	-	8.1-12.9	10.6-14.9	8.1	10.9	18.4	10.8-14.3	7.4-9.9	N.D.[1]
pH, Units	5-9	6.5-9.0	-	-	7.8-8.2	7.8	7.9	8.0	8.0	7.9-8.3	7.8-8.1	7.8-8.0
DO, mg/1	---------aerobic-------				10.7-10.9	7.2	7.9	7.4	6.7	5.3-6.3	7.5-8.0	N.D.[1]
Alkalinity, mg/1	-	-	-	-	36.0-174.5	68.6-114.7	47.6	51.2	51.5	79.1-84.3	177.0-218.9	N.D.
Color, units	-	-	-	-	N.D.	30.5-52.2	37.1	43.4	35	6.3-38.2	17.0-64.0	N.D.
Turbidity, TU	-	-	-	-	12.0-31.4	11.6-20.1	8.7	25.3	28.9	3.9-44.4	7.0-41.1	3.0-62.0
TDS, mg/1	-	-	-	-	22.2-47.2	263-368	163	187	169	203-327	300-843	290-340
TSS, mg/1	-	-	-	-	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	39-800	64-520
TVS, mg/1	-	-	-	-	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	11-23	N.D.
Set Solids, mg/1	-	-	-	-	0.12-1.0	N.D.	N.D.	N.D.	N.D.	N.D.	0.1-0.26	N.D.
Hardness	-	-	-	-	96-199	128-134	83.5	89.4	74.8	111-119	253-365	N.D.
Conductivity, mmhos	-	-	-	-	0.2-0.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Phosphate, mg/1	-	-	-	-	0.14-2.96	0.52-1.32	0.22	0.49	0.03	0.08-0.12	0.18-3.64	N.D.
Phosphorus, mg/1	-	-	-	-	0.09-1.02	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ortho-Phosphate, mg/1	-	-	-	-	N.D.	0.29-1.00	0.01	N.D.	0.08	0.08	0.05-3.34	N.D.
Nitrate, mg/1	10	-	-	100	0.47-1.78	0.27-0.41	0.24	0.32	0.2	0.04	0.07-3.35	0.4-0.9
Nitrite, mg/1	1.0	-	-	10	0.007-0.14	0.006-0.01	0.01	0.002	0.0	0.005-0.01	0.02-0.56	0.1
COD, mg/1	-	-	-	-	40.0	22.0-76.9	16.8	26.9	14.0	17.4-27.0	35.5-55.1	N.D.
BOD, mg/1	-	-	-	-	2.2-7.8	N.D.	N.D.	N.D.	N.D.	N.D.	2.5-10.1	1.9-4.5
TKN, mg/1	-	-	-	-	3.5-5.8	N.D.	N.D.	N.D.	N.D.	N.D.	1.7	1.7-4.8
Total Coliform, #/100 ml	-	-	-	-	1149-63,000	591-13,000	91	412	1710	14-28	441-8644	N.D.
Fecal Coliform, #/100 ml	2000	200	2000	-	424-21,000	N.D.	N.D.	N.D.	N.D.	N.D.	30-133	10-110
Ammonia, mg/1	0.5	-	-	-	0.22-2.46	0.21-0.35	0.28	0.17	0.09	0.11-0.22	0.19-5.41	0.1
Fluoride, mg/1[2]					0.69-0.79	0.87-0.97	0.69	0.90	0.54	0.69-0.76	0.7-1.39	0.77-0.9
Cyanide, mg/1	0.2	-	-	0.2	0.0-0.0009	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Aluminum, mg/1	-	-	-	-	0.0-0.0024	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Arsenic, mg/1	0.05	-	-	0.1	0.0-0.0007	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cadmium, mg/1	0.01	-	-	0.01	0.0001-0.0005	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chromium, mg/1	0.05	-	-	0.1	0.0-0.0038	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Copper, mg/1	1.0	-	-	0.2	0.009-0.046	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Iron, mg/1 (diss)	0.3	-	-	-	0.71-0.91	0.87-1.2	1.3	1.8	2.6	0.18-2.08	0.05-1.68	0.05-0.11
Lead, mg/1	0.05	-	-	0.1	0.007-0.019	N.D.	N.D.	N.D.	N.D.	N.D.	0.03-0.02	0.01-0.02
Magnesium, mg/1	-	-	-	-	8.5-12.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Mangenese, mg/1 dissolved	0.05	-	-	0.2	0.31-0.68	0.55-0.65	0.9	1.2	0.6	0.12-0.55	0.05-7.0	0.1-0.31
Molybdenum, mg/1	-	-	-	-	0.032-0.13	0.20	0.4	0.39	0.02	N.D.	N.D.	N.D.
Selenium, mg/1	0.01	-	-	0.02	0.0001-0.0013	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zinc, mg/1	5.0	-	-	2.0	0.08-0.55	N.D.	N.D.	N.D.	N.D.	N.D.	0.04-0.09	0.04-0.09
Chloride, mg/1	250	-	-	-	10.0-49.9	8.8-29.6	3.8	3.7	5.4	8.9-10.2	11-47.5	9.0-13.0
Sodium, mg/1	-	-	-	-	15.2-74.4	N.D.	N.D.	N.D.	N.D.	N.D.	33-240	36-44
Sulfate	250	-	-	-	68.0-143.0	N.D.	76.0	N.D.	N. D	N.D.	75-435.2	75-100
Calcium, mg/1	-	-	-	-	67.6-147.9	32.8-42.7	21.5	23.1	21.4	37.2-38.6	N.D.	N.D.
Boron, mg/1	-	-	-	0.75	0.03-0.17	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

[1] N.D. - No Data

[2] Criteria based on annual average of the maximum daily air temperature.

FIGURE B-2


N
W
E
S
WATER QUALITY MONITORING STATIONS
● Station Locations
← Sewage Treatment Plant
2 1 0
MILES
BOULDER COUNTY
WELD COUNTY
25
Firestone
Frederick
Dacono
BULL CANAL
CANAL
Creek
River
Treatment Site
WELD COUNTY
ADAMS COUNTY
ADAMS COUNTY
Big Dry
BULL
CANAL
Broomfield
Westminster
Platte
BOULDER COUNTY
JEFFERSON COUNTY
NORTHGLENN
HIGHLINE
Standley Lake
DITCH
FARMERS
South
25
CANAL
Crestview
Denver Metro
CHURCH
CROKE
Arvada
Creek
Clear Creek Valley
Clear
Wheatridge
N.W. Lakewood

agriculture are 1.0 mg/l and 10 mg/l, respectively. The agriculture and water supply nitrate criteria have not been violated in either the Clear Creek system or the Big Dry Creek system. Nitrate and nitrite mean concentrations increase below wastewater treatment plants but do not exceed criteria.

The remaining parameters exhibit similar trends of increasing concentrations below treatment plants.

Biological Parameters

Coliform bacteria are organisms that indicate the possible presence of disease causing organisms such as pathogenic bacteria, virus, worms, and protozoas. The use of total coliform as an indicator of pathogenic organisms has a long history. However, there is variable correlation of total coliform content with contamination by excreta. Fecal coliform is a more specific indicator of warm-blooded animal contamination. This is substantiated through examination of the excrement from other warm-blooded animals which indicates that fecal coliformscontribute to 93 percent of the total coliform populations. Fecal coliform criteria for a raw water supply and for Class I and Class II recreation are 2000/100 ml, 200/100 ml, and 2000/100 ml, respectively.

Total coliform concentrations in Clear Creek increase downstream. Mean total coliform concentrations range from 1149/100 ml, above Golden, to 62,939/100 ml near its mouth. Increases in the lower stream segment are believed to be, in part, a result of wastewater discharges. Canals taking water out of Clear Creek have mean total coliform densities at their headgates that range from 91/100 ml to 12,992/100 ml. Standley Lake has mean concentrations below 30/100 ml throughout its profile.

Mean concentrations of total coliform in Big Dry Creek range from 441/100 ml to 8644/100 ml. The Broomfield wastewater treatment plant discharge appears to increase concentrations.

Mean concentrations of fecal coliform in Clear Creek increase significantly as the stream passes through Denver. Mean concentrations increase from above Golden (424/100 ml) to the mouth (21,000/100 ml). These values exceed all criteria. No fecal coliform data are currently available for the canals or Standley Lake. (See Figure B-5.)

Mean fecal coliform concentrations in Big Dry Creek above and below the Broomfield treatment plant are about 50/100 ml. Concentrations below the Westminster treatment plant indicate concentrations decrease downstream. Mean concentrations in the Big Dry Creek and Bull Canal are below the Class I recreation criterion of 200/100 ml. (See Figure B-6.)

Toxic Parameters

The water supply criterion for ammonia is 0.5 mg/1. Violations of this value are noted in the lower segments of Clear Creek. This is partly the result of wastewater treatment plant discharges. Ammonia concentrations in Big Dry Creek below the Broomfield treatment plant violate the criterion but values in the Bull Canal do not.

The water supply and agricultural criterion for cyanide is 0.2 mg/1. This value is exceeded near the mouth of Clear Creek. No other toxic contaminants are present in toxic concentrations in the system.

Metals

Data for arsenic, cadmium, chromium, copper, and selenium are currently only available in Clear Creek. Data for zinc and lead are available for both the Clear Creek and Big Dry Creek systems. Mean concentrations of all of these parameters are below their respective criterion.

Water supply criterion (0.05 mg/l) for manganese are for dissolved, while the agriculture criterion (0.2 mg/l) is for total. Data are for concentrations of total manganese. The agriculture criterion is violated at all monitoring stations in the Clear Creek system. Only one station in the Bull Canal exceeded the agriculture criteria.

Inorganic Minerals

Inorganic minerals for which data are currently available include: chloride, sodium, sulfate, calcium, and boron. Water supply criteria have been recommended for chloride (250 mg/l) and sulfate (250 mg/l) while agriculture criterion are recommended only for boron (0.75 mg/l).

Chloride concentrations in both the Clear Creek system and the Big Dry Creek system are well below criterion limits.

Sulfate criterion is exceeded in Big Dry Creek at five stations. Mean concentrations at these stations range from 273 mg/l to 435 mg/l.

Boron data are currently only available in Clear Creek. Mean concentrations are below the agriculture criterion of 0.75 mg/l.

Radionuclides

Radionuclides have been monitored in Standley Lake sediment to determine if contamination by emissions from Rocky Flats Plutonium Plant has occurred (19). The primary parameter of concern to the study was plutonium 239.

The Colorado water quality standards (8) state that, "the radioactivity of surface waters shall be maintained at the lowest practicable level and shall, in no case, except when due to natural causes, exceed the latest federal drinking water standard."

Taken collectively, the plutonium-239 results for sediment samples collected from Standley Lake did not indicate any discernible contamination.

Standley Lake is within the"Area of Concern" as defined by the Colorado Department of Health. Areas of concern are downwind of the Rocky Flats Plant where exposure risks would be the greatest during a radiation emergency. EPA requires the development of a notification mechanism for existing and prospective residences who would be effected by an emergency condition at Rocky Flats, based on the State Radiological Emergency Response Plan including the grantees role in carrying out prescribed protective actions. (See Chapter 5).

Conclusion

The existing water quality data for the Clear Creek and Big Dry Creek systems has been evaluated in terms of compliance with water quality criteria for water supply, recreation and agriculture. The quality of water in irrigation canals seems to remain relatively constant throughout their reaches. Conversely, maintenance streams such as Clear Creek and Big Dry Creek have fluctuating water quality. This situation is a result, in part, of wastewater treatment facilities discharging into the main streams, while irrigation canals receive limited pollutant contributions from urban areas.

Data on the Bull Canal are limited to one sample. Supplemental monitoring has occurred but these data were not available at the time of this report. From the limited data, water quality in the Bull Canal is of a relatively good quality.

Manganese and BOD are parameters of interest in this analysis because the concentrations in the Bull Canal appear to be related to the Broomfield wastewater treatment plant. The differences in concentration in the Bull Canal and Big Dry Creek are probably a result of different monitoring periods. It is thought that additional monitoring of the two streams would correlate water quality in the headwaters of the Bull Canal more closely to the Big Dry Creek water quality and influence from Broomfield.

Two parameters are of special concern to this assessment, fecal coliform and nitrates. Fecal coliform is an indicator of possible health risks. Nitrates can create problems for water supplies and nitrogen sensitive crops. Existing water quality data in the Bull Canal indicates these parameters are below their criterion limits. However, fecal coliform concentrations in Big Dry Creek and in Clear Creek increase below wastewater treatment plants. Similarly, nitrate, nitrite, and ammonia-nitrogen concentrations increase below wastewater discharges.

WATER QUALITY PROFILE
Nitrate Nitrogen in mg/l
CLEAR CREEK

WATER QUALITY CRITERIA

WATER SUPPLY	10 mg/l as N
IRRIGATION	100 mg/l as N
LIVESTOCK	100 mg/l as N

Values Represent Maximum Permissible Concentrations Except As Noted

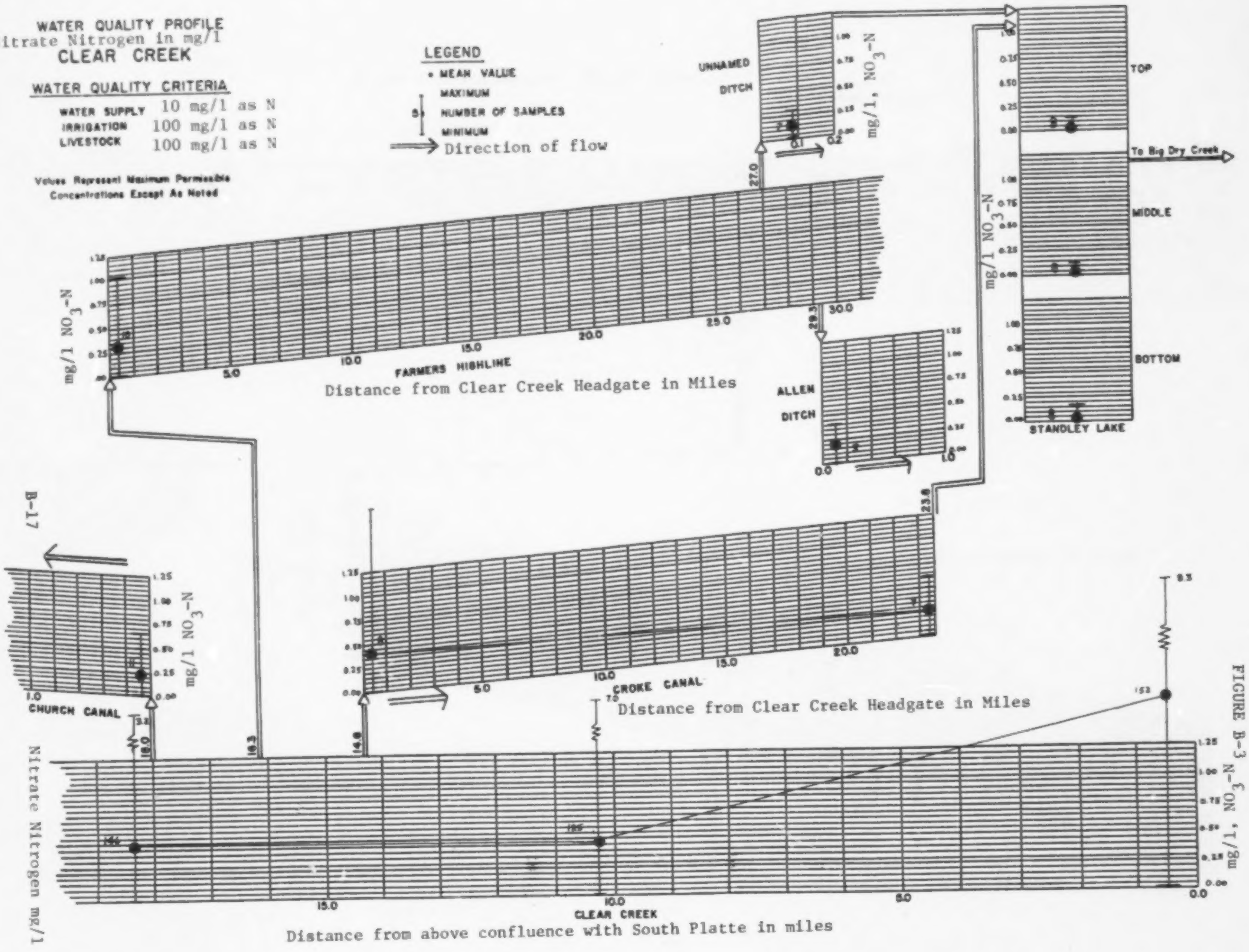


FIGURE B-3

WATER QUALITY PROFILE

BIG DRY CREEK

Nitrate Nitrogen in mg/1

WATER QUALITY CRITERIA

WATER SUPPLY	10 mg/1 as N
IRRIGATION	100 mg/1 as N
LIVESTOCK	100 mg/1 as N

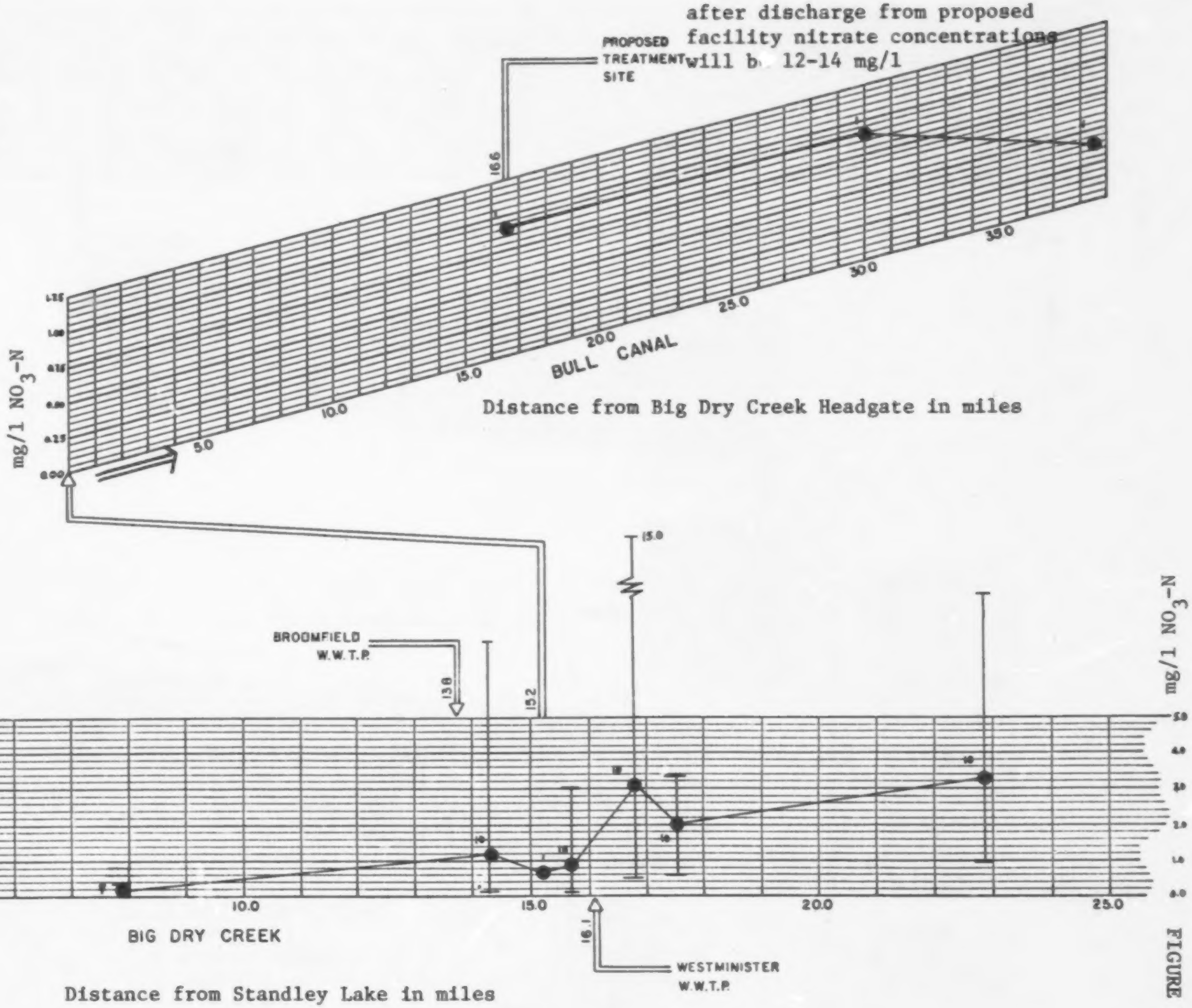
Values Represent Maximum Permissible Concentrations Except As Noted

LEGEND

- MEAN VALUE

MAXIMUM / NUMBER OF SAMPLES / MINIMUM

⟹ distance of flow

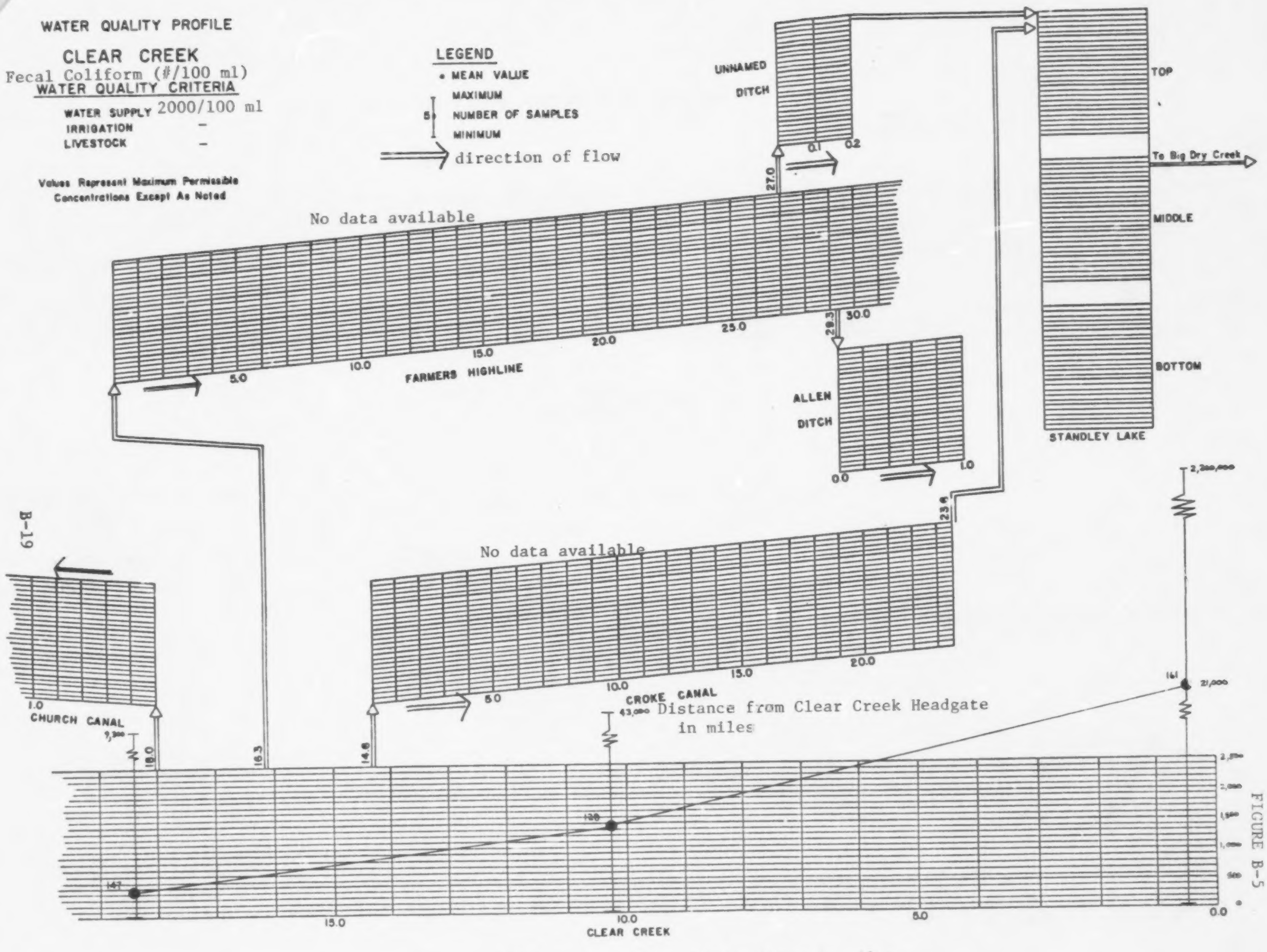


after discharge from proposed facility nitrate concentrations will be 12-14 mg/1

Distance from Big Dry Creek Headgate in miles

Distance from Standley Lake in miles

FIGURE B-4



WATER QUALITY PROFILE

CLEAR CREEK

Fecal Coliform (#/100 ml)

WATER QUALITY CRITERIA

WATER SUPPLY 2000/100 ml
IRRIGATION –
LIVESTOCK –

Values Represent Maximum Permissible Concentrations Except As Noted

FIGURE B-5

FIGURE B-6

WATER QUALITY PROFILE

BIG DRY CREEK

Fecal Coliform (#/100 ml)

WATER QUALITY CRITERIA

WATER SUPPLY 2000/100 ml
IRRIGATION –
LIVESTOCK –

Values Represent Maximum Permissible Concentrations Except As Noted

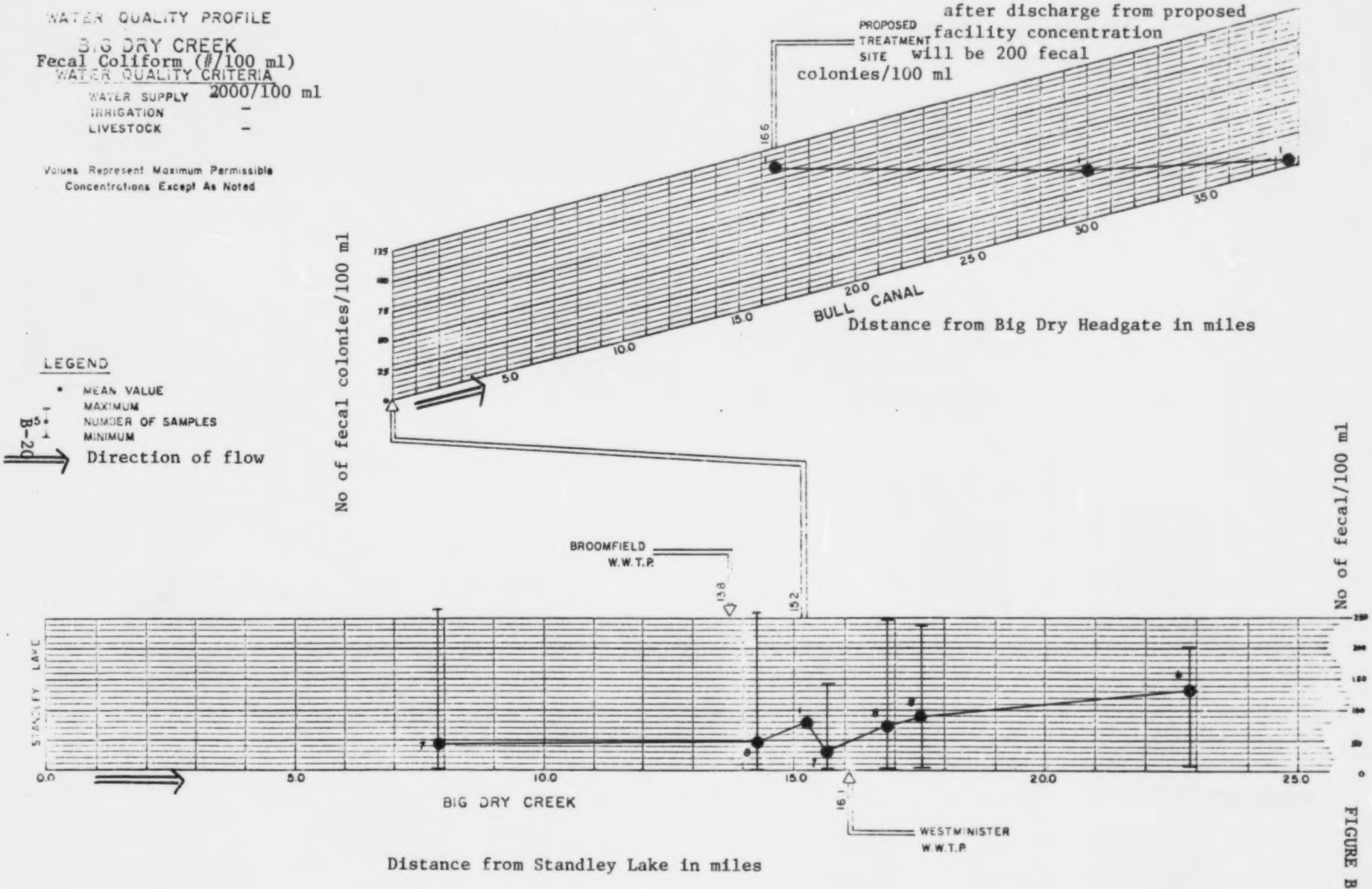


FIGURE B-6

AGRICULTURE IN THE STUDY AREA

Agriculture is an extremely important industry in the State of Colorado, along the front range, and in the FRICO and lower South Platte portions of the Study Area. Through urban encroachment, land erosion, land policies, or land development, Colorado has lost six percent of its productive land in the last two decades (9). Along the Front Range irrigated crop land has decreased from 700,000 acres to 660,000 acres from 1959 to 1978 (9). In view of the potentially critical impact nationwide of the reduction in agricultural land, the current EPA policy is ". . . to protect. . . . the Nation's environmentally significant agricultural land from irreversible conversion to uses which result in its loss as an environmental or essential food production resource." (10)

To understand the implications of the proposed exchange of reclaimed water for irrigation water, it is necessary to first define the soils, irrigation practices, crops, and current productivity of the agricultural lands in the Study Area.

Soils and Soil Productivity

The USDA Soil Conservation Service (SCS) has conducted detailed soil surveys for the region. The soils survey for Southern Weld County is, at present, unpublished (11, 12). The major soils within the Study Area have a textural range from sandy loams to clay loams, with minor areas identified as clays and sands. Soils of the region generally reflect the tertiary and pleistocene sediments at the eastern edge of the Rocky Mountain system, with minor sediments derived from the Denver and Arapahoe Arkose formation. Recent alluvium deposits occur along major stream valleys. Soils can generally be grouped into the high terrace and alluvial fan soils, old terrace and plains soils, ridgecrest and slope soils, upland soils, floodplain soils, and the sandhill area soils.

Soil fertility is naturally low within the survey area. Nitrogen, and to a lesser degree phosphorus are needed for best crop production in the irrigated areas. Zinc and Iron are the only nutrients known to be deficient in many of the soils (11, 12). Most irrigation water contains enough of the minor elements to meet the annual requirements of commonly grown crops.

Soil capability classifications used by the SCS are interpretive groupings made primarily for agricultural purposes. In this classification the arable soils are grouped according to their potentialities and limitations for sustained production of the common cultivated crops. Thus, the most productive soils under irrigation, have Class I capability ratings whereas those with limitations are rated with higher roman numerals. Class I soils have few, if any, limitations that restrict their use. Class II soils have some limitations and Class III soils have moderate limitations which reduce the choice of crops or require moderate conservation practices. Class IV, Class V, and Class VI soils have limitations, which make them generally unsuited for cultivation and limit their use largely to pasture or range. Potential flooding, uneven topography, excessive rock or tree cover, seasonal high water tables, drainage problems, inadequate depth to bedrock, excessive slope, and clay subhorizons are the reasons for poor ratings. The major irrigated soils within the Study Area are identified as Class II and Class III soils with minor areas rated as Class I, Class IV and Class VI.

Irrigation Practices in the Study Area

All methods of irrigation are suited for the soils within the Study Area, except where slope is a limiting factor. Furrow irrigation is most common.

Furrow irrigation is accomplished by gravity flow of water in narrow channels fed by a head ditch. Water seeps into the soils from the sides and bottom of the furrows. Water is introduced into each furrow by a siphon tube from the head ditch. Crops commonly irrigated in the area are alfalfa, corn, sugar beets, barley, and field beans.

Where slope is a limiting factor, contour ditches, corrugations, contour furrows, cross-slope furrows, and sprinklers are used. Rotating boom-type sprinklers are used in the Study Area on limited acreages. According to the Weld County Extension Service (13) there is a trend to replace furrow irrigation with sprinklers. The two major reasons for this trend are to increase water application efficiencies and to decrease labor cost.

Cropping Patterns

The irrigated farmland within the Study Area produces a wide variety of crops. The main crops are corn for grain and silage, alfalfa, sugar beets, and field beans. A common cropping system is a 3 to 4 year rotation of alfalfa followed by corn for grain, corn for silage, sugar beets, small grains or field beans. This type of rotation allows maximum use of available soil nutrients. Malt barley is also grown on limited acreage within the Study Area.

Most of the corn grown in the area is used for feed at commercial feedlots, farm feedlots, and dairies. Significant numbers of sheep and turkey are raised on the feed crops grown in the area (11). Sugar beets and malt barley crops are commonly contracted by Great Western Sugar Corporation and Coors Brewery, respectively.

A rotation of small grain and summer fallow is the main type of farming on the non-irrigated acreage. Wheat is the principal dry-farm crop, but barley and sorghum are also grown.

In the 27 year period from 1950 to 1977, Colorado Agricultural statistics (14) show an increase in the acreage planted in corn and wheat. Barley, field beans, sugar beets, and sorghum have gradually declined since 1950. However, during the same period of time yields per acre for all crops have increased. This may be attributed to more efficient farm management practices and advanced technology in agricultural practices.

Present Production and Yield

Production and yields for FRICO lands and lands along the South Platte that might be removed from production due to the project have been developed. Presented in Table B-3 are the estimated 1979 crop irrigated and nonirrigated acres in the FRICO Standley Lake Division. Listed in Table B-4 are the estimated crop yields and crop values for FRICO lands in 1979. The estimated value of crops produced from irrigated lands within the FRICO Standley Lake Division in 1979 is \$2,164,000. According to recent information from FRICO, Standley Lake releases for 1979 will be approximately 14,425 acre-feet. Based on current farm headgate yields of approximately 60 percent of the release, the 1979 farm deliveries will be 8655 acre-feet. Therefore, the FRICO farmers gross productivity based on water deliveries is estimated at \$250 per acre-foot of water delivered at the farm headgate.

Some of the options evaluated may result in the transfer of some water rights from land near the South Platte River to the FRICO Standley Lake Division to satisfy part of Northglenn's requirement to return 110 percent of the water borrowed from FRICO. Therefore, farm productivity along the South Platte lands that could be affected has been determined. Presented in Table B-5 is a summary of the crop values. The farm headgate delivery to these South Platte lands is 3,192 acre-feet. The estimated value of crops produced from irrigated lands near the South Platte in 1979 is \$349,500. The gross productivity of those specific lands along the South Platte is therefore \$109/acre-foot of water delivered to the farm headgate.

CLIMATE

The Front Range area around Denver is a transition area from plains climate to the climate of the foothills. This area is characterized as a high elevation continental, semi-arid climate.

Temperatures are typically moderate, with a mean monthly temperature of 10.1°C (50.2°F). Ranges in extremes have been recorded from -35.58°C (-30°F) to 40°C (104°F).

Annual average precipitation for the region is 37 centimeters (14.5 inches) with a large proportion of the rain falling from April to September. Thunderstorm activity accounts for much of this precipitation. Heavy thunderstorms in the foothills and plains areas occasionally cause damaging floods. The area has a low relative humidity which is a major factor in the areal potential evapotranspiration rate of 611 millimeters (24 inches). This amount is nearly twice the average precipitation and is an indication of the arid nature of the area. Periods of drought one to two years in length are common in portions of Adams County (12).

TABLE B-3

ESTIMATED DISTRIBUTION OF IRRIGATED AND NON-IRRIGATED AREAS WITHIN FARMERS RESERVIOR AND IRRIGATION CO., STANDLEY LAKE DIVISION IN 1979

CROP	AREA (ACRES)*			PERCENTAGE OF TOTAL AREA		
	IRRIGATED	NON-IRRIGATED	TOTAL	IRRIGATED	NON-IRRIGATED	TOTAL
Corn (Grain/Silage)	4,850	0	4,850	32	0	32
Alfalfa	1,970	0	1,970	13	0	13
Spring Wheat	0	1,033	1,033	0	7	7
Winter Wheat	0	834	834	0	5	5
Barley	767	700	1,467	5	5	10
Sugar Beets	606	0	606	4	0	4
Field Beans	152	0	152	1	0	1
Fallow	0	3,031	3,031	0	20	20
Dairy	0	62	62	0	1	1
Non-Agricultural	0	1,151	1,151	0	7	7
TOTAL	8,345	6,811	15,156	55	45	100

*Estimated from planimetering maps of cropping pattern in 1979 within Farmers Reservoir and Irrigation Co., Standley Lake Division.

TABLE B-4

ESTIMATED 1979 CROP VALUE IN FRICO STANDLEY LAKE DIVISION

Crop	Yield Per Acre[1]	1979 Market Value[2]	Crop Acres	Crop Value[3] Irrigated	Crop Value[3] Non-Irrigated
Alfalfa	4 ton	$ 49.50/ton	1970	$ 390,000	$
Corn (grain)	100 bu	2.74/bu	3395[3]	930,000	
Corn (silage)	16 ton	18.31/ton	1455[3]	426,000	
Sugar Beets	16.6 ton	29.00/ton	606	290,000	
Field Beans	27.5 bu	10.00/bu	152	42,000	
Barley (irrigated)	42.5 bu	2.64/bu	767	86,000	
Barley (non-irrigated)	16.5 bu	2.11/bu	700		24,000
Wheat (non-irrigated)	16.5 bu	3.76/bu	1867		116,000
			10,912	$2,164,000	$140,000

[1] Weld County County Extension Service.

[2] From Northern Feed and Bean, Western Alfalfa Corp, Farmers Marketing Association, Monfort Farms, Coors Brewery, Great Western Sugar Co.

[3] Assume 70 percent of corn to be harvested as grain and 30 percent as silage.

TABLE B-5

ESTIMATED CROP VALUE-SOUTH PLATTE RIVER IN 1979 DOLLARS

Crop	Yield Per Acre[1]	1979 Market Values[2]	Crop Acres[3]	Crop Value Irrigated
Alfalfa	4.2 tons	49.50/ton	456	95,500
Corn (grain)	140 bu	2.74/bu	303	116,200
Corn (silage)	13.8 tons	18.31/ton	129	32,500
Sugar Beets	18.6 tons	29.00/ton	157	84,500
Field Beans	23.6 bu	10.00/bu	65	15,340
Barley (irrigated)	43.6 bu	2.64/bu	48	5,500
				349,540

[1] Estimated historic yields based on current market value of crops and information provided by Colorado Agricultural statistician, Lance Fretwell.

[2] Northern Feed and Bean, Western Alfalfa Corp, Farmers Market Association, Monfort Farms, Coors Brewery, Great Western Sugar Company.

[3] Wright-McLaughlin Engineers, Depletion Studies on the Fulton Ditch, Lupton-Bottom Ditch, and Burlington Ditch-Wellington Reservoir System.

Snowfall is generally not heavy, with most snow occurring between November and April. The growing season, or frost-free period is between April and September.

Wind data are summarized on the Annual Wind Rose (Figure B-7). Generally, the winds are out of the south. Occasionally upslope conditions prevail which follow the South Platte River drainage from the northeast (15). Downslope conditions are more complex but generally are from the northwest with some winds out of the southwest. Local wind patterns will vary seasonally and diurnally.

GEOLOGY

Subsurface and geologic conditions are identified at the proposed wastewater treatment facility and storage reservoir. Investigations have been conducted at the proposed site (16, 17) and reviewed. The existing subsurface and geologic conditions are summarized below:

Northern Adams County and southern Weld County are located at the northwest edge of the Denver Basin. This region of the basin is separated from the rest of the basin by the South Platte River. The Denver Basin is a large north-south trending asymmetrical, structured downwarp (18). The west side of the Basin has been folded and faulted by the uplifting of the Front Range.

The bedrock geology of the reservoir site area consists of the Dawson Group (Arapahoe Formation), the Laramie Formation, and the Fox Hills Sandstone.

The Late Cretaceous, Arapahoe Formation has been eroded away in this area with about 50 feet of the basal Arapahoe remaining (16). Some locations in the area are void of the Arapahoe as a result of faulting and erosion. This formation consists of interbedded sandstones and clay shales with occasional lenses of conglomerate.

The non-marine Laramie Formation (Late Cretaceous) underlies the Arapahoe and is about 600 feet thick. This formation consists of interbedded shales, siltstone, occasional sandstones and a few localized coal beds. The top of the Laramie is an erosional surface and is unconformably overlain by the Arapahoe Formation (16).

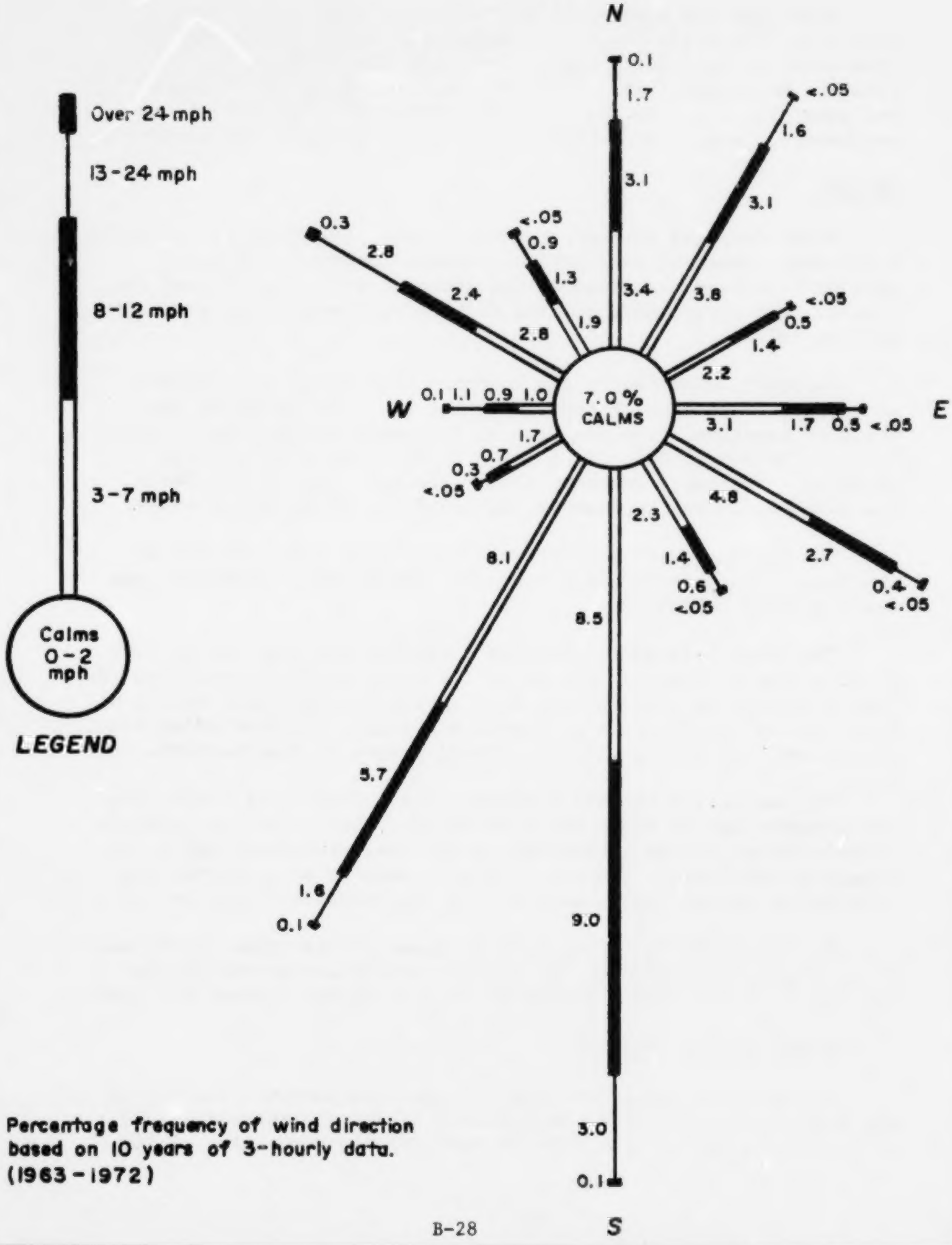
The Fox Hills Sandstone is the oldest of the three formations. It is a Late Cretaceous marine deposit of sandstones and shales. The top of the Fox Hills Formation is at a depth of about 650 feet.

Faults and Earthquakes

The historic seismicity and geologic and tectonic history of the area has been reviewed to evaluate earthquake susceptibility (17). Faults in the area were formed with the deposition of the

FIGURE B-7

ANNUAL WIND ROSE
STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO



Percentage frequency of wind direction
based on 10 years of 3-hourly data.
(1963-1972)

Laramie and Arapahoe Formations in Late Cretaceous time (16). These faults are classified as not potentially active and are not believed to present any danger of movement (16, 18).

However, the area is within the Denver Seismic Zone and is therefore subject to influence by seismic activity in the zone. The Denver Seismic Zone does not coincide with a major fault zone and surface fault ruptures have not been associated with historic earthquakes (17). This has resulted in the following conclusion (17):

> "The Denver Seismic Zone is a potential source of future earthquakes, however, judging from the lack of major faults in the area, it is unlikely that future earthquakes would exceed magnitudes greater than 5.5 to 6.0 (Richter Scale)."

Because there is a potential for future earthquakes, design features of any structure must account for earthquake stress. It has been recommended that facilities related to the Northglenn plan be designed for a maximum design earthquake that corresponds to a Modified Mercalli Intensity of VIII (17), which corresponds to a magnitude of between 6.1 to 6.7 on the Richter scale near the epicenter. This earthquake is based on what is considered to be a reasonable credible earthquake in the Denver earthquake zone.

ARCHAEOLOGICAL/HISTORIC RESOURCES

From February 28 to March 1, 1978, Dr. Dean Arnold, Department of Sociology-Anthropology, Wheaton College, Illinois, conducted an "Archeological Survey for the Area Affected by the Northglenn Water Management Program." At the conclusion of this survey, he determined that there were "no known significant archeological sites nor cultural resources that would be destroyed or adversely affected by the proposed project."

The only area of interest identified in this survey was an "historic dump of recent period probably 1900-1940 A.D.," which site was referred to as "5AM66." This site was located on the east side of the right-of-way of York Road, approximately 50 meters from the crest of the hill, in the general vicinity of the proposed site for the Northglenn force main. To avoid any interference with or impact on the 5AM66 site, the City of Northglenn has agreed to locate the force main on the west side of York Road, well away from that site.

In addition, Northglenn agrees to include in all construction contracts a provision requiring the contractor to halt construction should any archeological artifact be discovered, and to notify the City immediately. The City, in turn, will notify the State Archeologist's office prior to authorizing the recommencement of construction at the site. Should the State Archeologist's office request time to examine the site prior to recommencement of construction, Northglenn will provide this opportunity.

To summarize, the Archeological Survey has disclosed no areas of significance in the vicinity of the Northglenn sewage treatment facility. With respect to site 5AM66, the City will relocate its force main to avoid any impact on that site. Finally, the City will include in all construction contracts, a provision to halt construction to permit evaluation and protection of any artifacts with archeological or cultural significance.

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15. Personal communication, National Weather Service, Stapleton International Airport, September 25, 1979.

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APPENDIX C

LITERATURE REVIEW OF PUBLIC HEALTH RISKS

APPENDIX C

LITERATURE REVIEW OF PUBLIC HEALTH RISKS

Shuval has recently reviewed general wastewater reuse considerations (1). He reported results of recent unpublished studies in Israel indicating that poliovirus inocculated in sewage could be detected in the soil and on cucumbers seven days after irrigation. These results, as well as others such as the cholera outbreak in Jerusalem in 1970 (2), were attributed to irrigation with sewage receiving only primary treatment without any disinfection. Aerosal dispersion studies of microorganisms (3) also indicate the importance of treatment process and controls in order to reduce health risks of water reclamation for irrigation.

The World Health Organization (4) suggests treatment processes for various reuse options. These options are summarized in Table C-1. Reuse of reclaimed water for irrigation of food crops, with the indicated processes and proper disinfection, are felt to be essentially free of health hazards. The key requirement is proper disinfection which is defined as: "the art of killing the larger portion of microorganisms. . .with the probability that all pathogenic bacteria are killed" (5). Chlorination of ordinary wastewater usually does not kill all pathogenic organisms, especially viruses. However, recent work at the University of California at Berkeley (6) and at Pomona, California (7) indicates that virus inactivation is possible through in-depth filtration (to remove micro-particulates) and maintenance of a chlorine residual in the effluent for at least two hours.

Based on the experience cited, it is clearly important to note the conditions involved before relating them to the proposed Northglenn project.

Waterborne Diseases and Outbreaks

Many surveys on waterborne disease causing organisms have been published (8, 9, 10, 11, 12 and 13). A summary list of diseases that are potentially transmitted by food contaminated with wastewater and/or fecal material is presented in Table C-2. Parasites that cause hookworm, schistosomiasis and leptospirosis, which are transmitted from human wastes and are capable of penetrating human skin, are a potential health problem to farm workers (8).

Viruses. A report by Taylor provides an overview of the virus problems stating the types of viruses found in water and the diseases they cause (13). Viral diseases that have been linked to sewage include polio, menengitis and infectious hepatitis (11). The infectious hepatitis virus has not yet been isolated from any source media. Information concerning infectious hepatitus is inferred from epidemiological data and other tests on human subjects (14).

TABLE C-1

SUGGESTED TREATMENT PROCESSES TO MEET THE GIVEN HEALTH CRITERIA FOR WASTEWATER REUSE[a]

	Irrigation			Recreation			Municipal Reuse	
Health Criteria[b]	Crops Not for Direct Human Consumption (A + F)	Crops Eaten Cooked; Fish Culture (B + F or D + F)	Crops Eaten Raw (D + F)	No Contact (B)	Contact (D + G)	Industrial Reuse (C or D)	Non-Potable (C)	Potable (E)
Primary Treatment	∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘
Secondary Treatment		∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘	∘∘∘
Sand Filtration or Equivalent Polishing Methods		∘	∘		∘∘∘	∘	∘∘∘	∘∘
Nitrification						∘		∘∘∘
Denitrification								∘∘
Chemical Clarification						∘		∘∘
Carbon Adsorption						∘		∘∘
Ion Exchange or Other Means of Removing Ions								
Disinfection		∘	∘∘∘	∘	∘∘∘	∘	∘∘∘	∘∘∘[c]

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[a] Reproduced with the permission of the World Health Organization from Reuse of Effluents: Methods of Wastewater Treatment and Health Safeguards. WHO Technical Report Series No. 517, Geneva, 1973.

[b] Health criteria: A Freedom from gross solids; significant removal of parasite eggs. B as A, plus significant removal of bacteria. C as A, plus more effective removal of bacteria, plus some removal of viruses. D Not more than 100 coliform organisms per 100 ml in 80% of samples. E No fecal coliform organisms in 100 ml, plus no virus particles in 1,000 ml, plus no toxic effects on man, and other drinking-water criteria. F No chemicals that lead to undesirable residues in crops or fish. G No chemicals that lead to irritation of mucous membranes and skin. In order to meet the given health criteria, processes marked ∘∘∘ will be essential. In addition, one or more processes marked ∘∘ will also be essential, and further processes marked ∘ may sometimes be required.

[c] Free chlorine after 1 hour.

TABLE C-2

DISEASES AND CAUSATIVE AGENTS TRANSMISSIBLE BY FOOD THAT HAS BEEN CONTAMINATED BY WASTEWATER OR BY SOIL THAT CONTAINS FECAL MATERIAL (8)

Disease	Agent
Bacteria[a]	
Arizona infection	*Arizona hinshawii*
Bacillus cereus gastroenteritis	*Bacillus cereus*
Cholera[b]	*Vibrio cholerae*
Clostridium perfringens gastroenteritis	*Clostridium perfringens*
Enteropathogenic *Escherichia coli* infection	*Escherichia coli* (certain serotypes)
Paratyphoid fever[b]	*Salmonella paratyphi* A *Salmonella paratyphi* B *Salmonella paratyphi* C *Salmonella sendai*
Pseudotuberculosis	*Pasteurella pseudotuberculosis*
Salmonellosis[b]	*Salmonella* (over 1,500 serotypes)
Shigellosis[b]	*Shigella sonnei* *Shigella flexneri* *Shigella dysenteriae* *Shigella boydii*
Typhoid fever[b]	*Salmonella typhi*
Yersinia gastroenteritis	*Yersinia enterocolitica*
Viruses	
Adenovirus infection	Adenoviruses
Coxsackie infection	Coxsackie viruses
ECHO virus infection	ECHO viruses
Poliomyelitis	Polioviruses
Reovirus infection	Reoviruses
Viral hepatitis[b]	Hepatitis virus A
Winter vomiting disease	Norwalk agent
Helminths	
Ascariasis[b]	*Ascaris lumbricoides*
Trichiniasis	*Trichuris trichiura*
Protozoa	
Amebiasis[b]	*Entamoeba histoyltica*
Balantidiasis	*Balantidium coli*
Coccidiosis (*Isospora* infection)	*Isospora belli*, *I. hominis*
Dientamoeba infection	*Dientamoeba fragilis*
Giardiasis	*Giardia lamblia*

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[a] Other enteric bacteria which could conceivably be transmitted by foods but proof is inconclusive: *Streptococcus faecalis*, *s. faecium*, *Proteus* spp., *Providencia* spp., *Citrobacter freundii*, *Enterobacter* spp., *Edwardsiella* spp., *Aeromonas* spp., *Pseudomonas aeruginosa*.

[b] Reported outbreaks.

Inactivation of the infectious hepatitis virus depends on the level of water treatment and disinfection. Work by Young (15) shows that out of 28 cases reported by Mosely, only four occurred where complete treatment was available. Of those, one occurred after treatment was by-passed, one lacked the evidence to implicate conclusively the water supply, another resulted when a concentration of 0.8 mg/l of chlorine was being applied to the water with no record of a 30-minute residual, and the last happened where chloramines were used for disinfection and plant records were inadequate to allow analysis.

McDermott reports virus in 5 out of 32 samples in the finished water of one community and in 2 out of 32 samples in another community (12). The infectious dose required to cause disease in humans by viruses is unknown but is recognized as significantly less than that dose required for bacterial infectious diseases.

Aerosol Transmission of Pathogens. One concern at sewage treatment plants is the health hazard posed by aerosols from the wastewater. In a survey by Hickey and Reist (16) the increase in likelihood of contracting a respiratory disease because of working at a wastewater treatment plant was reported to be insignificant. The number of Klebsiella inhaled at a treatment plant are about one-eighth that needed to produce infectious disease. Although inconclusive, the incidence of pneumonia in workers at both water and wastewater treatment plants was reported to be the same. Data concerning influenza and colds were not conclusive.

Sorber (17, 18) has shown in pilot plant studies that aerosols can disperse pathogens found in domestic sewage. A decrease in the number of inhaled infectious viral units occurred with a corresponding decrease in infectious viral units in the sewage. The viricidal effect of sunlight and higher temperatures was found to be definite, although the effect of relative humidity varied with different types of virus. In aerosols, the majority of bacteria die off in the first three seconds of exposure while some persist.

A review by Stanford and others (19) analyzed the morbidity risk factors associated with spray irrigation of wastewater. The authors state that a literature search has not revealed any incidence of disease from irrigation with properly treated sewage (e.g., chlorinated secondary effluent). They also state that the formation of droplets smaller than 500 microns in diameter should be prevented.

Katzenelson (3) presented data on aerosol hazards due to spray irrigation with contaminated river water and aerated lagoon effluent. Coliform bacteria and Salmonella were found 350 meters and 60 meters (1,150 and 200 ft), respectively, from the sprinklers when contaminated river water was used. Only coliform bacteria were found in tests on aerosols from an aerated lagoon, and these were at a maximum distance of 30 meters (100 ft) from the sprinkler sites.

Irrigation with Wastewater Effluent. A committee organized by the Sanitary Engineering Division of the American Society of Civil Engineers stated that no outbreaks of disease due to crop irrigation with secondary effluent had been reported with the systems in use up to 1970 (20). However, a number of outbreaks have been associated with various types of foods contaminated with wastewater, some as a result of irrigation. One outbreak resulting from contaminated vegetables occurred with the use of unchlorinated secondary effluent. All other outbreaks were connected with water treated to a lesser extent (8).

Katzenelson (21) demonstrated the hazards of using partially treated nondisinfected oxidation pond effluent for irrigation. A survey of the incidence of shingellosis, salmonellosis, typhoid fever and infectious hepatitis showed that these diseases were two to four times more prevalent in communities where spray irrigation was practiced than in others. Unconfirmed cases of influenza also occurred twice as often where spray irrigation with oxidation pond effluent was used. However, no sigifnicant difference in disease incidence was noted during the winter nonirrigation season.

One of the main hazards of irrigating crops with poorly treated sewage is the possible spread of infectious hepatitis. Neefe and Stokes demonstrated that the infectious hepatitis virus is transmitted in the feces of humans. In another article by the same author (14), the effects of the infectious hepatitis virus were shown to be much less severe after exposure of effluent to high concentrations of chlorine, but only partially diminished after treatment by aluminum sulfate or activated carbon.

Survival of Pathogenic Organisms in the Environment

Bacteria. A review by Sepp (23) includes discussion of the survival time of many organisms where wastewater is used for irrigation. Extremely long survival times of such agents as Ascaris eggs and Salmonella necessitate their elimination during wastewater treatment.

The major factors that influence bacterial survival in soil are soil type, moisture, pH, sunlight, and temperature (24). pH values between 2.9 and 4.5 inactivate most bacteria, whereas less inactivation occurs with pH values between 5.8 and 7.8. Sunlight tends to inhibit bacterial growth, while (within the ranges normally encountered) bacterial survival increases with increasing moisture and temperature. Bacterial die off however can be reduced with colder temperatures. Monitoring data from lagoon systems in North Dakota indicate the highest levels of fecal coliform occur during the winter.

The summary provided by Gerba et al (24), describes several experiments on the movement of coliform bacteria through soil. In all cases the die-off of the coliform bacteria from secondary effluent was substantial after movement of the effluent through 6 meters to 10 meters (20 to 30 ft.) of soil.

Virus. Fujioka and Loh (25) indicate the poliovirus can survive for 32 days in soil irrigated with secondary effluent. Experiments by Leffler and Kott (26) demonstrated longer survival times for bacteriophage f2 than for poliovirus. In sand saturated with both tap water and oxidation pond effluent, f2 was detected after 175 days, whereas poliovirus was not detected after 91 days. Bitton (27) reviewed studies on virus movement through soil.

Duboise et al (28) demonstrated differences in the penetration rates of viruses through soils resulting from the use of intermittent instead of continuous flows. Young and Burbank's work with Hawaiian soils showed that poliovirus passed through columns in which coliphage T4 was trapped (29). Using coliphage T2 and poliovirus, Bitton (30) presented evidence that secondary effluent caused desorption of viruses from soils particles. Interference by the organic matter present in the secondary effluent was suggested as the reason for desorption.

Most of the cases of viral and pathogen contamination of food crops have occurred with irrigated crops (8). Studies by Bagdasaryan (31) indicated that survival of enterovirus on vegetables is dependent on temperature. A 99.6 percent die-off in ten days was noted with tomatoes at a temperature of 18° to 21°C (64° - 69°F), compared with a 90 percent loss when kept for ten days at 4° to 10°C (39° - 50°F).

Larkin et al (32) grew vegetables in plastic-lined wooden boxes, spraying them with virus-laden sludge and effluent. The vegetables were allowed to weather extensive periods of direct sunlight, high temperatures and periodic rainfall. Though 99 percent of the seeded polio was inactivated during the first five to six days, virus still could be detected on the lettuce and radishes after 36 days in one test and after 14 days in another. Other tests using oxidation pond effluent were conducted by Kott and Fishelson (33). Under conditions of greater than minimal sunlight, no virus could be detected on the vegetable surface after 28 hours.

Drewry and Eliassen (34) concluded that virus movement through soils under saturated conditions should present no real health hazard to ground water supplies. However, studies by Wellings, et al (35, 36) show that virus can remain infective after aeration, sunlight and percolation through 20 feet of sandy soil. Wellings also demonstrated vertical and lateral movement of virus, as well as survival in sandy soil for 28 days during a period of heavy rains. Due primarily to analytical difficulties, data concerning the mobility and survival rates of infectious hepatitis is limited.

Removal of Pathogens by Treatment Processes

Different levels of pathogen removal by various treatment processes should be considered when using reclaimed water. Bryan (8) discussed the removal of a wide variety of bacteria and virus by processes in sewage treatment plants. Malina (37) analyzed more specifically virus removal by processes in both water and wastewater treatment plants.

Primary Sedimentation. Primary sedimentation normally removes less than 50 percent of the pathogenic bacteria from sewage (8). The wide variation in virus removals documented is probably due to variations in the concentrations of incoming suspended solids (37). Viruses are known to adsorb to suspended solids and, hence, be much less detectable in an analysis of the liquid phase. This does not necessarily imply that their ability to infect is altered (38).

Biological Treatment. Biological treatment normally removes about 90 percent of the pathogenic bacteria (8). The different types of biological treatments vary somewhat in their ability to remove virus. Activated sludge and aerated lagoon systems are the two most effective. Both can remove more than 90 percent of the incoming viruses. Careful operation can achieve removals of greater than 98 percent (37).

In another study by Malina (39), the sensitivity of virus removal to changes in different parameters of the activated sludge process was examined. Virus inactivation was found to be independent of 1) organic loading 2) hydraulic detention times and mixed liquor suspended solids concentrations, and 3) whether oxygen or air was used in the process. Virus adsorption to sludge was found to be almost immediate. It was determined also that inactivation in the process occurs in a time-stable sludge-virus complex. Further information concerning virus inactivation in activated sludge can be found in several other publications (19, 25, 40, 41).

Disinfection. Various disinfecting agents have received attention (21, 42, 43, 44, 45, 46, 23, 24, 25, 26, 27), but chlorine remains the most widely used. Several factors influence the effectiveness of chlorine in deactivating pathogens. These are discussed in an article by Culp (47) and are: 1) pH and the concentration of hypochlorous acid present; 2) detention time; 3) turbidity or solids content (the lower the concentration of particulate matter, the more effective is disinfection); 4) presence of oxides of iron, ammonia, manganese and hydrogen sulfide; 5) presence of organic compounds; 6) temperature; and, 7) mixing.

Effective disinfection of wastewater with chlorine generally requires a good quality effluent, (e.g. 30/30 BOD and suspended solids) good mixing, adequate contact time and chlorination to the breakpoint to obtain a free chlorine residual.

The use of ozone as a disinfectant has recently been given increased consideration. In a comparison of ozone with chlorine (46), it was noted that ozone oxidizes phenols, cyanides and pesticides more completely than does chlorine. It also is unaffected by the presence of ammonium. Disadvantages of its use are lack of residual, cost and high sensitivity of bactericidal effectiveness to method of application.

Coagulation. Various studies with coagulation-flocculation processes have concluded that this is the most effective method of virus inactivation in water treatment plants besides disinfection (43).

Removals of greater than 99 percent have been recorded often (30, 31, 32, 48, 49, 50, 51, 52).

Chudhuri (53) concluded that coagulation-flocculation could not be expected to operate with high virus removal efficiency in wastewater because of the presence of organic matter. This conclusion contradicts the findings of Sobsey et al (54), who showed that 99.95 percent of seeded influent virus were removed from raw sewage by a packaged wastewater treatment system using alum flocculation. Sobsey et al concluded that alum flocculation and activated carbon adsorption with subsequent removal by diatomaceous earth filtration were functionally more important than chlorine in removing virus when raw sewage was processed. Later tests on secondary effluents by Wolf et al (52) showed greater than 99.7 percent removals obtained in a large-scale pilot study.

Sand Filtration. Rapid sand filtration in conjunction with flocculation is an effective means of removing virus. Sand filtration is used in wastewater treatment to remove cysts and Ascaris eggs (8).

Carbon Adsorption. Carbon adsorption has been considered an effective means of removing virus from water. Tests show that over 90 percent removal is possible. However, one conclusion about this process may preclude dependence on carbon adsorption for virus reduction. Gerba et al (43), found that when the capacity of the carbon column to adsorb virus is reached, desorption may occur with the replacement of virus by organic substances. Such an occurrence could cause a surge of viruses to enter the distribution system, resulting in a highly virus-laden effluent.

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APPENDIX D

ALTERNATIVE WATER SUPPLIES AND ENVIRONMENTAL EFFECTS

APPENDIX D

ALTERNATIVE WATER SUPPLIES AND ENVIRONMENTAL EFFECTS*

Within the Denver Metropolitan area, municipalities have several options available for a water supply source. The very basic options consist of developing a water resource on the West Slope, or East Slope of the continental divide or a combination of both. This can occur by developing/acquiring existing or new surface sources and for groundwater.

WEST SLOPE WATER

Three options are considered for Northglenn's water supply originating on the West Slope. The options include:

- ° Development of new appropriations
- ° Acquire existing water rights
- ° Participation in existing water development projects

New appropriations would require the creation of new water rights on the West Slope. However, the availability of new appropriations in the Colorado River Basin are not expected to provide a dependable water supply. West Slope water availability is diminishing with the growth of the West Slope, planned transmountain diversions, and perfecting of existing rights. Energy development demands, primarily oil shale, are expected to use most of Colorado's share of the water allocated under the Colorado River Compact. Lower basin states are expected to exercise their rights under the Colorado River Compact and thus place a demand for their adjudicated water below the Colorado state line. This new demand will inadvertently impact water users in Colorado by transmitting waters to the lower basin states. There is a high probability that a lower basin demand will be imposed prior to the year 2000, and will be concurrent with the completion date of the Central Arizona Project. It is expected that this new demand will curtail the use of direct flow and storage water rights junior to 1970 and may even affect rights junior to 1960.

Acquiring existing water rights involves the purchase of water rights that are now physically in existence. Water rights could be purchased from agricultural users or from an existing transmountain diverter. A West Slope agricultural water right is expected to yield from 0.75 to 1.25 acre feet per acre. Based on these figures the Northglenn required agricultural land purchases would be from 6,000 to 10,000 acres.

Northglenn could participate in an existing West Slope water project with another municipality. Projects which Northglenn may be eligible to participate in include:

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*Note: Another water supply alternative has been developed by opponents to Northglenn's plan, but information on this new alternative was submitted too late to be considered here. See Appendix M.

° Aurora's Homestake Project

° Colorado Big Thompson

° Windy Gap

Participation in the City of Aurora's Homestake Project is questionable at this time. The estimated yield from this project ranges from 10,500 acre feet in an average year to 3,300 acre feet in a dry year. It is unclear if Aurora has water supplies in excess of its own requirements, and construction completion is not projected until 1988.

There is a possibility that Northglenn could participate in either the Colorado Big Thompson Project (CBT) or Windy Gap Project.

Existing stipulations prohibit the use of CBT water outside boundaries of the Northern Colorado Water Conservancy District (NCWCD). Northglenn is presently outside these boundaries and is therefore ineligible for CBT water. Northglenn could potentially be annexed into NCWCD by one of two methods: NCWCD board approval and court petition, or formation of a new subdistrict of the NCWCD. NCWCD is concerned with their ability to meet present water demand projections, and past court petitions for water have been defeated on the basis of impairing the rights of present CBT water users. Furthermore, NCWCD's present water supplies have been allocated to existing users within the district. The extent of Northglenn's privileges as a new subdistrict would only be that of attempting to buy out an existing user's right.

At present, the water supplies which will be developed by the municipal subdistrict of the NCWCD through the Windy Gap project have been allocated. Upon Northglenn's admission to the subdistrict, Northglenn would have to purchase part of the allotment of an existing participant. No excess water is currently available from any of the existing participants. In the event that Windy Gap water became available, Northglenn could take delivery at Boulder Reservoir. A pumping station and pipeline would then convey the water to Northglenn's water treatment plant. A 5,300 acre foot reservoir would be required to provide for the five month winter shutdown of Windy Gap.

ENVIRONMENTAL EFFECTS OF DEVELOPING WEST SLOPE WATER

Each of the West Slope water supply alternatives considered for Northglenn will result in an adverse environmental impact to Colorado's West Slope.

The most severe physical impact to the Colorado River basin of transmountain diversions has been associated with reduction in flows and associated increases of salinity. Salinity pollution in the Colorado River has been increasing, which results in serious economic impacts to the existing municipal, industrial, and agricultural users. Any new appropriation and transmountain diversions of Colorado River water will compound these impacts. If Northglenn were to acquire existing water rights, the associated impacts could potentially be less in terms of water quality, but would result in a reduction of irrigated agriculture in Colorado.

Acquisition of new or existing water rights on the West Slope to support a water demand on the East Slope is also constrained economically and politically. The time involved in developing a water supply is extensive and institutional arrangements difficult in addition to the need to overcome engineering problems of conveyance. The construction of the facilities needed to deliver the water to Northglenn would have minor impacts.

Again the use of Windy Gap water by Northglenn would cause additional East Slope agricultural water right conversions. The development of Windy Gap, as a project, would cause an increase in salinity.

EAST SLOPE WATER

East Slope water supply for the Denver Metropolitan area is of an extremely competitive nature because of projected short falls in water supply. For the Northglenn Water Resource Management Plan, EPA has considered the following water supply sources:

- New appropriation
- Acquiring existing water rights
- Participation in existing water supply projects

New appropriations would require new water rights from the South Platte River. Intense competition exists for any further allocation of the South Platte River and its tributaries. It is thought that the allocation of rights on the South Platte have been over extended in some instances. A flow of 5,000 cubic feet per second (cfs) in the South Platte River is considered necessary to realistically satisfy the perfected direct-flow water rights on the mainstream, even though the decreed water rights far exceed 5,000 cfs. Flows in excess of 5,000 cfs would represent surplus water available to a new appropriation. Flows in excess of 5,000 cfs were experienced only ten years during the period 1896 to 1975. If the Narrows Reservoir is constructed and its conditional water right perfected, no surplus water upstream of Narrows would be available. Because of the unreliability of new appropriations in the South Platte River basin, municipal water supplies would not be feasible and new reservoir storage development would largely be supported by independent water supplies or by existing decrees.

New appropriations of non-tributary water from the deep underlying aquifer of the Denver Basin are available. Northglenn has applied for such water rights.

Acquiring existing water rights on the East Slope would involve the conversion of agriculture water. The market place and price of water rights on the East Slope have been changing drastically in recent years. Municipalities, because of their excess demands, are in competition for agricultural water rights and prices for such water is rapidly increasing. Municipalities have the right to condemn agricultural water as a last resort to obtaining needed supplies. The conversion of agricultural water rights to meet municipal demands is exerting pressures on agricultural water rights, and threatening the present agricultural economy.

The existing systems available for Northglenn to pursue as water supply options are: Denver Water Board, Thornton, and FRICO exchange.

Denver Water Board (DWB) has indicated in the past that it would be interested in serving Northglenn's water supply. Although recent reports have indicated current supplies may not meet its present water demands beyond 1998, long-range future supplies are under study. The Denver City Charter prohibits water service outside the City limits if there is not enough water for the intercity water requirements. Presently the DWB has adopted a policy of exercising caution in entering new contracts for outside service and is limiting the number of annual taps for new service. The DWB has stated that it fully intends to scrutinize any additions to the service areas of its existing raw water customers, and contracts for the distribution of raw water supplies outside the service boundaries will be stopped.

If water service was available from Denver, either raw water service or treated water service could be considered as an available alternative.

Northglenn currently is receiving water fom the City of Thornton and could continue. Future service would be subject to Thornton's agreement to provide water and Thornton having sufficient water resources. Thornton officials have indicated the City is capable of providing an adequate quality of water and is agreeable to continue to provide such service to Northglenn in the future.

Thornton is currently developing additional water resources for the city and has applications in court for a number of various water rights. Studies and documentation concerning Thornton's present supply and future plans were not available for this analysis; however, a general, overall discussion with City officials concerning this alternative has provided information for considering Thornton for Northglenn's water supply.

Thornton currently has a dry year yield of water approaching 20,000 acre feet per year which is adequate to supply Thornton's and Northglenn's current demand of about 14,000 acre feet per year. Northglenn uses about 40 percent of the total or 5,600 acre feet. Utilization of reservoir storage with Thornton's direct flow rights could increase the dry year yield from 4,000 to 6,000 acre feet. Also, a proposed exchange with the Burlington Ditch could add another 7,000 acre feet. Thornton estimates it will require 20,000 acre feet per year by the year 2000 without providing service to Northglenn. Assuming reservoir storage and the Burlington exchange is ultimately incorporated into Thornton's water supply system, Thornton would have a yield slightly over 30,000 acre feet which would meet the combined requirements of Thornton and Northglenn for the year 2000. Thornton's ultimate need is estimated to be 45,000 acre feet without Northglenn. These estimates are based on current projections as estimated by Thornton. Thornton is in the Water Court on a number of projects and in the process of finalizing other water supply sources; therefore, conditions could change substantially in the near future. The presenbt water supply sources for the City of Thornton come from water rights located in Upper Clear Creek, Lower Clear Creek, South Park, and pumping alluvial groundwater from the South Platte River basin under G.A.S.P. G.A.S.P. or Groundwater Appropriator of the South Platte river basin, Inc., is a non-profit organization of volunteer members formed to provide replacement water for tributary well pumping in the South Platte River Basin. G.A.S.P. rents approximately 30,000 acre feet of water each year from various sources, including the Colorado-Big Thonmpson project and Union and McClellan reservoirs. This water is turned over to the State to be released as necessary to replace water withdrawn from the South Platte system between Denver and the Nebraska and Wyoming state lines. Currently a member of G.A.S.P. is required to replace five percent of the total well diversion.

According to Thornton's officials, planning for Thornton's water supply in the future consists of the following:

1. The City will continue with an active program of purchasing additional agricultural rights along Clear Creek.

2. Although Thornton does not currently own any rights on the West Slope, there is a possibility of a joint venture development of West Slope water in conjunction with other water users.

3. Thornton will continue to purchase agricultural rights in the South Park area.

4. The City has filed for new storage rights in South Park and has a storage exchange agreement with Aurora in Aurora's proposed Spinney Mountain Reservoir.

5. Thornton has currently an application pending with the Water Court to allow an exchange with the Burlington Ditch along the South Platte River.

6. The possible expansion of tributary wells under G.A.S.P. is also an alternative for future supplies to the City.

The FRICO exchange is considered an existing system because of the various water sources associated with this alternative. This alternative can utilize a combination of deep non-tributary well developments, purchase of existing water rights, and an exchange agreement between Northglenn and FRICO. This plan is the proposed alternative and is described in detail in the proposed water supply section of Chapter 3.

ENVIRONMENTAL EFFECTS OF DEVELOPING EAST SLOPE WATER

The most severe environmental impact of developing East Slope water as a water supply source is a reduction in irrigated agriculture. This impact is most critical to agriculture along the South Platte River and areas adjacent to Metropolitan Denver. New appropriations of water would have the least effect on agricultural production. However, as stated above, new surface water is not readily available. Furthermore, if the Water Court were to determine that new water required augmentation, it is probable that augmentation water would come from agricultural uses.

It is possible that municipalities facing water shortages in the future will condemn extensive areas of agricultural land for water rights. Such water use will serve to damage an important part of Colorado's economy. Because of the previously mentioned condition of the agricultural land in the vicinity of Denver, it is not in the best interest of agriculture to pursue this type of water acquisition.

If Northglenn received its water supply service from Denver, the impacts would be related to transmountain diversions with the attendant impacts previously described.

The alternative of Northglenn continuing to receive its water supply from Thornton is possible should Thornton expand its water supply as previously discussed. One additional option available to Thornton is to purchase all of Northglenn's water rights and incorporate them into the city's water rights system. The total amount of water available from such a potential purchase, not including the Northglenn-FRICO exchange agreement, is 3,400 acre feet in a dry year. The total agricultural impact of purchase of the existing rights now owned by Northglenn is $ 600,000.

If the entire 5,942 acre feet required for Northglenn is provided by Thornton from the South Park area, there will be an impact on agriculture in that area as well. A firm yield utilizing storage in the South Park area of about 1.0 acre foot per acre could be realized with the purchase of relatively senior South Park agricultural rights. The cost of 5,942 acre feet of consumptive use may average $2,000 per acre foot or a total of $11.9 million dollars. According to the Colorado Agricultural Statistics, the predominant South Park crop is pasture and hay with a yield of less than 1.0 ton per acre. Assuming an average irrigated production of 1.0 tons per acre and $60 per ton cost for hay, the total amount of reduced agricultural production is $360,000 based on 1979 figures.

The environmental impacts of the Northglen-FRICO exchange are presented in the agricultural productivity section of Chapter 4.

WATER SUPPLY ALTERNATIVE CONSIDERED FOR COST ANALYSIS

Water supply alternatives considered above have been evaluated to identify those which are considered the most feasible water supply options available to Northglenn. Water supply alternatives considered acceptable are discussed below.

West Slope

Of the alternatives available to Northglenn on the West Slope, Windy Gap appears to be the most advantageous water resource.

This alternative would involve obtaining water from the Windy Gap subdistrict of the NCWCD. There are 480 units available in the project at 100 acre feet per unit. To ensure an adequate water supply, Northglenn would need to purchase 75 units for a total entitlement of 7,500 acre feet per year.

Water transmission would require a pumping plant and pipeline to convey the supply, most likely from the Boulder Reservoir, to Northglenn's water treatment plant. The required pipeline would need to be 42 inches in diameter, and approximately 22 miles long. The pump station would need to provide a total dynamic lift of 360 feet. For annual operation and reliability, 5,300 acre feet of reservoir storage capacity would be needed. The reservoir could be either newly constructed or an expansion of the Boulder Reservoir.

East Slope

The alternatives for water supply available to Northglenn on the Ast Slope would be supplied from the Denver Water Board, Thornton, or FRICO.

Denver Water Board

There are two options available for obtaining water from the Denver Water Board. The options are either to purchase raw water or treated water.

Raw Water Supply - Under a raw water contract agreement, Northglenn could receive raw water supply at the Ralston Reservoir. Transmission of raw water from Denver would be provided through a 36-inch pipeline approximately nine miles long. The transmission main would have an alignment from Ralston Reservoir to northglenn's treatment plant. The flow of water in this transmission line would be by gravity.

Treated Water Supply - For this option, Northglenn would contract with the Denver Water Board for full water service. Treated water supply from Denver would be provided at 50th and Washington Streets. Transmission of water would be through a 36-inch diameter eight-mile long pipeline to Northglenn's proposed water storage tanks. A pump station having 400 foot total dynamic head would be required.

Thornton

The least impact on agriculture would occur if Thornton were to provide all of Northglenn's future water demand from water resources developed in the South Park area. Conveyance to Thornton from south Park is expected to be via the South Platte River.

FRICO

The alternative operational options for exchanging water and source of the water is described in the Proposed Water Supply section of this Chapter.

APPENDIX E

REVIEW OF PROPOSED SYSTEM PERFORMANCE

E-0

APPENDIX E

REVIEW OF
PROPOSED NORTHGLENN
WASTEWATER TREATMENT SYSTEM

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION VIII

by

ENGINEERING-SCIENCE, INC.

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CHAPTER I
INTRODUCTION

The U.S. Environmental Protection Agency, Region VIII, has evaluated and analyzed the proposed lagoon wastewater treatment system and Bull Canal Reservoir for the Northglenn Water Management Program in terms of: (1) the treatment concepts used to develop the system, (2) the translation of the treatment concepts to final design, and (3) the sufficiency of supporting data and raw waste data for the proposed system. This report is intended to present the results of these evaluations.

The second chapter of this report presents the treatment concepts as developed by Professor Ross E. McKinney of the University of Kansas as well as an evaluation of the applicability of these concepts, the sufficiency of raw waste data and supporting treatability studies, and an evaluation of the system in terms of complying with proposed effluent quality criteria and public health aspects.

The third chapter discusses the conversion of the conceptual treatment techniques to the final design by Sheaffer and Roland, Inc. Particular areas of concern will be the aeration system, the development of low temperature (winter operation) treatment estimates, energy requirements, mitigation measures for algae control and other specific design details.

The final chapter presents a summary of the conclusions concerning the system.

CHAPTER II

TREATMENT CONCEPTS

This chapter describes and analyzes the treatment concepts on for the proposed Northglenn Project. Included is an analysis of the sufficiency of data on the raw waste characteristics and the sufficiency of studies providing supportive evidence for the proposed treatment concepts.

CONCEPTS

The basic concepts used in designing the proposed system were developed by Professor Ross E. McKinney for Sheaffer and Roland, Inc.

The basic treatment system proposed for Northglenn consists of a three-stage aerated lagoon system followed by a large storage reservoir. The effluent from the reservoir may be chlorinated if required. Mixing and oxygen requirements in the lagoons will be supplied via submerged static aerators.. The following description of these concepts is extracted from various letters and memoranda from Professor McKinney to Sheaffer and Roland, Inc. (References: Letter dated 2/18/78 from R.E. McKinney to F.J. Roland; Memorandum entitled "Proposed Aerated Lagoon for Northglenn, Colorado," prepared by R.E. McKinney and dated 4/4/78; and Letter dated 8/26/78 from R.E. McKinney to F.J. Roland and accompanying report entitled "Fundamental Concepts of Aerated Lagoons with Special Emphasis on Nitrification" by R.E. McKinney dated 8/22/78).

AERATED LAGOONS

Primary Cell

The specific design criteria for the aerated lagoon will depend on the wastewater characteristics. With normal domestic sewage, a 24-hour, complete mixing aerated lagoon should be adequate to convert the soluble BOD to microbial cells and to maintain an adequate microbial population. The 24-hour aerated lagoon should have a depth of 20 feet to take advantage of the improved oxygen transfer using static aerators. Maximum oxygen transfer will be required at this point. Closely spaced static aerators can provide good oxygen transfer and good mixing. The sizing of the aerators will depend upon the chemical characteristics of the wastewaters.

The use of complete mixing in the aerated lagoon cell provides optimum reaction between the microorganisms and the wastewater components. The soluble biodegradable organic materials are quickly metabolized in the aerated lagoon with only the resistant biodegradable suspended solids not being metabolized completely in the 24-hour retention period. The metabolic reaction results in conversion of the biodegradable organics to microbial cells which are suspended solids. The effluent from the 24-hour aerated lagoon will contain little soluble BOD; but will contain some of the suspended BOD and the microbial cells that will have a definite oxygen demand. There will also be considerable quantities of ammonia nitrogen from the degradation of proteins. The problems with the 24-hour aerated lagoon system is the need to remove the suspended solids in order to produce a high quality effluent.

The suspended solids discharged from the 24-hour aerated lagoon will be quite high, around 236 mg/l total SS. The BOD_5 will also be high, approximately 80 percent of the living mass of microbes. In this case the BOD_5 should be approximately 90 mg/l, giving slightly more than 50 percent BOD_5 reduction. Normally, 24-hour, completely mixed aerated lagoons give 50 percent BOD_5 reduction. Depending on the degree of metabolism of the suspended solids in the raw wastewaters, the BOD_5 reduction should be between 40 and 50 percent.

The objective of the second phase of the aerated lagoon will be to remove the solids and to stimulate nitrification.

Second Cell

The second lagoon will be concerned with endogenous respiration of the living mass and the start of nitrification during warm weather. Some suspended solids removal may also occur since the degree of mixing will be less than in the first aerated lagoon cell.

Since the oxygen demand is lower than in the 24-hour aerated lagoon, the four-day aerated lagoon has less aeration equipment with greater spacing to produce a mixing action that carries the solids around the aeration tank and down to the bottom where the heavy solids settle out.

The changing aerator spacing will permit the heavy solids to settle between the aerators and will keep the upper liquid aerobic.

The effluent from the second aerated lagoon will have less than 30 mg/l BOD_5 since some of the living mass will remain in the second aerated lagoon with the settled solids.

If suspended solids are not kept in suspension, some algae will start to grow in the second aerated lagoon cell. There will be sufficient nutrients for algal growths if light penetrates into liquid for sufficient time to allow the algae to grow. Reasonable mixing should insure that minimum algal growth will occur in the second aerated lagoon.

The effluent from the four-day aerated lagoon will go to a nine-day aerated lagoon with decreasing aeration to produce induced settling in the larger aerated lagoon. The size and spacing of the aeration equipment should be designed so that the fine suspended solids have an opportunity to impinge on the bottom of the lagoon and to be retained there. The mixing action of the aeration equipment should provide flocculation necessary for reasonable solids agglomeration and settling.

It is expected that the suspended solids will drop to 30 mg/l or less. The remaining suspended solids will be largely inert materials that would not create any significant BOD_5.

Nitrification

Nitrification will not become significant until the third cell. Some nitrification will occur in the second cell but it will be limited by the ability to retain the nitrifying bacteria in the second cell.

[In the third cell,] it is anticipated that nitrification will be close to being complete since adequate oxygen will be available for the reactions to be complete and time should allow for the microbes to grow.

The slow growing nitrifying bacteria will be adversely affected by the low temperatures in the winter months and the lack of incoming seed.

If nitrification should not develop to the degree anticipated, the system can easily be modified to produce the desired results. The proposed modification would consist of a series of redwood media boxes such as used in the ABF tower filter, anchored to the bottom of the lagoon around each aerator. The redwood boxes would form a support on which the nitrifying bacteria would grow and reach sufficient numbers that they would produce complete nitrification. The redwood boxes would form surfaces for other microbes and suspended solids to be retained. It is anticipated that the effluent suspended solids would be quite low unless a heavy algae growth resulted. Nitrification destroys alkalinity in proportion to the degree of nitrification. One mg/l ammonia nitrogen oxidized to nitrate nitrogen will destroy 7.14 mg/l alkalinity as $CaCO_3$. If sufficient alkalinity does not exist in the wastewaters, nitrification will not be complete. The data on available alkalinity and nitrification indicates that nitrification could remove most of the alkalinity and force carbon to be the limiting factor in the subsequent growth of algae in the storage reservoir. Thus, nitrification would not only shift the nitrogen from ammonia to nitrates but would reduce the potential algal growth, yielding a higher quality effluent.

It is expected that the effluent discharged from the aerated lagoon into the reservoir will have a BOD and SS under 30 mg/l unless excessive amounts of algae grow up. It is expected that with complete nitrification, there will be little carbon available for the alge to grow even though there will be excess nitrogen and phosphorus.

STORAGE RESERVOIR

The storage reservoir should be designed as deeply as possible with a minimum of surface area to reduce excess evaporation of effluent. The excess nitrogen and phosphorus could stimulate the growth of algae. With complete nitrification most of the alkalinity will be destroyed and little carbon will be readily available for the algae to grow on. The use of limited aeration could turn the reservoir over and minimize the sudden growth of algae. Slow mixing would keep the nutrients dispersed and would help remove the algae by flocculation and sedimentation within the storage reservoir.

The following excerpt describes the anticipated potential for algae growth in the Bull Canal reservoir as described by Dr. McKinney (Reference: Memorandum by R.E. McKinney dated 9/4/78 entitled "Anticipated Microbial Response in Reservoir for Northglenn, Colorado").

ALGAE

The stabilization of organic matter by bacteria produces a stable effluent as far as bacterial metabolism is concerned. In the presence of light energy the stable nutrients can be metabolized by algae to form algal protoplasm. In effect, the inorganics are converted back into organics which are no longer stable. The algae undergo endogenous respiration the same as bacteria. In the presence of light energy, the algae take the end product of endogenous repiration and convert them right back to new algae. The net result is that it appears that the algae remain unchanged when actually they are undergoing continuous change. In the dark, the algae undergo normal endogenous respiration with the release of nutrients. When light returns, the released nutrients can be metabolized again unless lost from solution during the dark period.

In natural water the growth of algae is limited by phosphorus; but in polluted water the growth of algae is limited by either nitrogen or carbon. Algal protoplasm has a chemical composition very similar to bacteria and can be represented by the empirical formula, $C_5H_9O_{2.5}N$. Phosphorus is normally 1/5 the nitrogen content. Normal domestic wastewaters contain approximately 200 mg/l BOD_5, 200 mg/l alkalinity as $CaCO_3$, 20 mg/l ammonia nitrogen, 15 mg/l organic nitrogen, and 10 mg/l phosphorus. It is possible to convert the BOD to its carbon equivalent and to do the same with the alkalinity. The BOD has approximately 112 mg/l carbon while the alkalinity contributes an additional 24 mg/l for a total of 136 mg/l carbon. Approximately 2/3 of the BOD carbon is put into bacterial cells in the synthesis reaction with a slow release of additional carbon during endogenous respiration. From a practical point of view, it is possible to estimate that 2/3 of the carbon related to the BOD would eventually be made available for algal metabolism in the aerated lagoon system where some suspended solids settling will occur. Actually some of the carbon dioxide would be lost to the atmosphere in the aeration cell through stripping at the aerator. The metabolism of protein by bacteria results in the release of ammonia which reacts with the carbon dioxide to produce ammonium bicarbonate alkalinity. Metabolism of 10 mg/l of organic nitrogen would only tie up 9 mg/l carbon from the carbon dioxide. With 200 mg/l alkalinity at pH 7, approximately 10 mg/l carbon would be retained as carbon dioxide in solution. The release of other minerals tied up by organic acids which were metabolized by the bacteria helps bind the carbon dioxide. Careful analyses would have to be made of the specific system to accurately determine the amount of carbon made available for algal growth. Alkalinity measurements after the synthesis phase of bacterial growth in a 24-hour aerated lagoon would indicate that the available inorganic carbon is in the range of 48 mg/l as bicarbonates.

The metabolism of bicarbonates by algae results in a pH shift upward with the production of carbonates from bicarbonates. The carbonates tend to raise the pH to a point where metabolism ceases. It is estimated that no more than 50 percent of the carbon in the bicarbonate alkalinity is available for metabolism. This means that the 24 mg/l converted to algal protoplasm would mean approximately 50 mg/l VSS or 55 mg/l TSS. If all the carbon could be converted to cell mass, the algal mass would be around 300 mg/l. The expected algal growth should be 1/6 the ultimate potential.

Nitrogen is a critical element for both bacteria and algae growth. The metabolism of 200 mg/l BOD by the bacteria would result in 17 mg/l nitrogen converted to cellular protein. Approximately 10 mg/l of the 15 mg/l organic nitrogen would be released by metabolism with 5 mg/l remaining unmetabolized. The net balance would require 7 mg/l of the ammonia nitrogen leaving approximately 13 mg/l ammonia nitrogen untouched. Endogenous respiration would release additional ammonia in proportion to the rate of endogenous respiration. If 2/3 of the nitrogen were eventually released by endogenous respiration, a total of 23 mg/l nitrogen would be available for algal growth. At 10 percent nitrogen the maximum potential growth would be 230 mg/l VSS or about 250 mg/l TSS as algal cells.

The 10 mg/l phosphorus represents a potential algal growth of 500 mg/l VSS or 550 mg/l TSS, making phosphorus the least limiting of the three elements. In addition to these elements, iron and magnesium are critical trace metals that

could also limit the total algal growth potential. Iron is the more sensitive of the two trace nutrients since iron reacts with phosphates to form a ferric hydroxy phosphate precipitate that results in removal of the essential iron. It is hard to establish iron deficient systems since growth simply levels off before it should.

It appears from these data that with domestic sewage carbon could easily become the limiting element in the growth of algae. The availability of the carbon is the critical factor in the final analysis. The loss of carbon dioxide during initial metabolism is the hardest factor to evaluate. In an aerated lagoon, the aerator-mixers help to drive off the carbon dioxide since the concentration of carbon dioxide in the air is quite small. The remaining alkalinity and pH are the key parameters for determining the available carbon. Recently, it has been shown that nitrification can play an important role in the alkalinity reaction. Nitrification results in the destruction of 7.1 mg/l alkalinity as $CaCO_3$ for each mg/l ammonia-nitrogen oxidized. If the 13 mg/l excess ammonia-nitrogen were oxidized in the first aeration cell, 92 mg/l alkalinity would be destroyed, dropping the alkalinity from 200 mg/l to around 110 mg/l. With a pH around 7.8, about 13 mg/l carbon would be available for algal metabolism, the total algae mass would be around 30 mg/l until endogenous respiration released additional carbon dioxide in the second aerated lagoon. If the algae were able to obtain all of the carbon released by endogenous respiration, the growth could reach 80 mg/l VSS or 90 mg/l TSS. The total algal mass leaving the second aeration cell could be as high as 120 mg/l. Further growth of algae would depend upon additional endogenous respiration of the bacteria or some other source of carbon. With sedimentation of solids in the thrid aerated lagoon, the algae population should show a significant decrease. A very important reaction occurs with the growth of the algae, the pH rises. It should reach well over 9 and might even reach 10. The pH should balance with the relative concentrations of alkalinity forms. As the pH rises, calcium carbonate will be precipitated as will iron and calcium hydroxy phosphate. The removal of iron and phosphate in the third aerated lagoon should be sufficient in itself to prevent further algae growth in the reservoir.

The effluent from the third aerated lagoon should have around 100 mg/l alkalinity and a pH above 9.0. During the summer months, the nitrogen should be essentially all nitrates if adequate oxygen is supplied. The precipitation of iron and other trace metals should reduce further algae growth to a minimum. The atmosphere will be the primary source of carbon but the rate of transfer will be small, depending primarily upon the degree of mixing at the air-water interface. It has been estimated that 8 mg carbon could be transferred across each meter of water surface per day which could yield

> approximately 20 mg of TSS per day if adequate light were available and the other nutrients were in excess. Mixing will be an important key to distributing the algae throughout the reservoir volume. Not only will mixing distribute the algae around the reservoir, mixing will assist in separation of the algae by contact with the bottom surfaces.
>
> Endogenous respiration of the algae results in a continuous degradation of the algae protoplasm. While the algae reuse the nutrients released by endogenous respiration, approximately 20 percent of the algae mass produced will remain as stable organic suspended solids which will not create an oxygen demand or release their nutrients. In fact, the 20 percent solid fraction will tie up carbon, nitrogen, and phosphorus. The net effect will be that nitrogen and/or phosphorus will become the limiting nutrient in the reservoir. The long retention time in the reservoir, 9 months should be adequate to provide a reasonable effluent.

ESTIMATED EFFLUENT QUALITY

The effluent quality expected from the system as estimated by Sheaffer and Roland based on the design concepts described in the previous section is presented in the following excerpts from a memorandum from Sheaffer and Roland to Bob McGregor dated November 16, 1979.

> Based upon expected annual BOD_5 and suspended solids loadings and reservoir release volumes, the anticipated NPDES effluent requirements will be from 23 to 26 mg/l BOD_5 and from 22 to 30 mg/l suspended solids depending on the amounts of precipitation and evaporation experienced in a given year.
>
> The Bull Canal reservoir is planned to receive 6,722 acre feet of water during an average year. The wastewater contribution to this flow is 5,200 acre feet annually, or 78 percent of the flow. Of the remaining 1,522 acre feet, 1,100 acre feet will be intercepted storm water and base flow from Grange Hall Canal, and 422 acre feet will come from well fields along the South Platte. During wet and dry years, these flows will vary as shown in Table 1 (repeated here for convenience as Table II-1).
>
> The expected BOD_5 and suspended solids concentrations of each inflow source can be estimated based upon wastewater and storm water sampling and analysis and existing well quantity data as presented in Table 2 (repeated here for convenience as Table II-2).
>
> Based upon NPDES requirements of 30 mg/l or 85 percent removal of BOD_5 and suspended solids, and Bull Canal reservoir releases as dicussed in the basis of design the effluent concentration needed to meet NPDES requirements are given in Table 4 (repeated here for convenience as Table II-3).

TABLE II-1

RESERVOIR INFLOWS

Source	Average Year (acre feet)	Wet Year (acre feet)	Dry Year (acre feet)
Domestic Wastewater	5,200	5,200	5,200
Grange Hall Creek Storm Water and Base Flow	1,100	1,400	1,000
South Platte Well Water	422	62	1,172
Total Inflows	6,722	6,662	7,372

SOURCE: Sheaffer and Roland, Inc., Memo of 11/16/79 to Bob McGregor from Lee Rozaklis, Subject: NPDES permit for Bull Canal Reservoir.

TABLE II-2
INFLUENT WATER QUALITY

Source	5-day Biochemical Oxygen Demand (mg/l)	Suspended Solids (mg/l)
Northglenn Wastewater (from Northglenn Volume 7)	200	190
Urban Stormwater and Base Flow (from Northglenn Volume 1)	20	300
South Platte Well Water	~0	~0

SOURCE: Sheaffer and Roland, Inc., Memo of 11/16/79 to Bob McGregor from Lee Rozaklis, Subject: NPDES permit for Bull Canal Reservoir.

TABLE II-3
EFFLUENT CONCENTRATIONS NEEDED TO MEET NPDES REQUIREMENTS

Average Year

BOD_5:

$$\frac{1{,}441 \text{ tons } BOD_5\text{/year} \times 9.09 \times 10^8 \text{ mg/ton} \times 0.15}{6{,}457\text{AF/year} \times 1.233 \times 10^6 \text{ liters/AF}} = 24.7 \text{ mg/l} \rightarrow 25 \text{ mg/l } BOD_5$$

Suspended Solids:

$$\frac{1{,}788 \text{ tons S.S./year} \times 9.09 \times 10^8 \text{ mg/ton} \times 0.15}{6{,}457\text{AF/year} \times 1.233 \times 10^6 \text{ liters/AF}} = 30.6 \text{ mg/l} \rightarrow 30 \text{ mg/l S.S.}$$

Wet Year

BOD_5:

$$\frac{1{,}449 \text{ tons } BOD_5\text{/year} \times 9.09 \times 10^8 \text{ mg/ton} \times 0.15}{6{,}432\text{AF/year} \times 1.233 \times 10^6 \text{ liters/AF}} = 24.9 \text{ mg/l} \rightarrow 25 \text{ mg/l } BOD_5$$

Suspended Solids:

$$\frac{1{,}910 \text{ tons S.S./year} \times 9.09 \times 10^8 \text{ mg/ton} \times 0.15}{6{,}432\text{AF/year} \times 1.233 \times 10^6 \text{ liters/AF}} = 32.8 \text{ mg/l} \rightarrow 30 \text{ mg/l S.S.}$$

Dry Year

BOD_5:

$$\frac{1{,}438 \text{ tons } BOD_5\text{/year} \times 9.09 \times 10^8 \text{ mg/ton} \times 0.15}{7{,}049\text{AF/year} \times 1.233 \times 10^6 \text{ liters/AF}} = 22.6 \text{ mg/l} \rightarrow 23 \text{ mg/l } BOD_5$$

Suspended Solids:

$$\frac{1{,}747 \text{ tons S.S./year} \times 9.09 \times 10^8 \text{ mg/ton} \times 0.15}{7{,}049\text{AF/year} \times 1.233 \times 10^6 \text{ liters/AF}} = 27.4 \text{ mg/l} \rightarrow 27 \text{ mg/l S.S.}$$

SOURCE: Sheaffer and Roland, Inc., Memo of 11/16/79 to Bob McGregor from Lee Rozaklis, Subject: NPDES permit for Bull Canal Reservoir.

The proposed aerated lagoon system, coupled with the storage reservoir, should effectively remove virtually all BOD_5 present in the influent wastewater. Any BOD_5 values in the reservoir outflows should be exclusively a function of algae cell concentrations.

Removal of influent BOD_5 will be a function of influent BOD_5 concentration, water temperature, detention time and bacterial cell concentrations in the lagoon.

The influent mixture of wastewater and storm water is expected to have an average suspended solids concentration of 196 mg/l, of which 94 mg/l is expected to be nonbiodegradable or very slowly biodegradable. This includes 22 mg/l of nonvolatile solids and 36 mg/l nonbiodegradable volatile solids from the domestic wastewater portion of the influent, and 36 mg/l nonvolatile solids from the storm water portion of the influent. Given the typically high specific gravity (1.25 to 1.40) of these solids, it is expected that these will settle out of the water, primarily in the third treatment cells and the settling basin of the reservoir.

The remaining 102 mg/l of the influent suspended solids, along with the dissolved BOD_5, will be quickly metabolized to produce an average of 140 mg/l of bacterial solids in the treatment cells. It is expected that 20 percent (28 mg/l) of these solids will be nonbiodegradable and will settle out as the bacteria are reduced by endogenous respiration. The remaining bacteria will diminish to low levels (described in the previous section) in the reservoir effluent. Thus, the suspended solids present in the influent are expected to settle out or be metabolized into bacterial solids which in turn will settle or will undergo respiration.

The algal cells concentration in the reservoir will have a peak BOD_5 value of 40 to 50 mg/l and a peak suspended solids value of 35 to 45 mg/l during the months of July and August assuming no settling of algal cells. Probable settling rates will be on the order of 60 percent, resulting in BOD_5 levels of 16 to 20 mg/l and suspended solids levels of 14 to 18 mg/l in the effluent.

The presence of algae is expected to be the major source of both BOD_5 and suspended solids in the reservoir effluent. Algae production is expected to occur primarily in the storage reservoir with some production in the third treatment cells. The lack of an initial population of algae in the influent wastewater, along with the high turbidity and high degree of mixing expected in the first two cells, is expected to limit algae growth in the first two cells.

Growth of algae requires the presence of carbon, nitrogen, and phosphorus as major nutrients, along with several other micronutrients such as iron and calcium. The concentration of nitrogen and phosphorus in the wastewater would

support algal concentrations of 550 mg/l and 750 mg/l, respectively, if either nutrient were limiting. However, it is expected that carbon will be the limiting fctor in this case.

Algae require carbon in the form of dissolved carbon dioxide, bicarbonate, or undissociated carbonic acid as a carbon source for growth. The influent mix of wastewater and storm water is expected to have an alkalinity of 308 mg/l as $CaCO_3$ (assuming 340 mg/l is wastewater and 200 mg/l is storm water).

The biodegradable organics in the influent will release an equivalent of 250 mg/l $CaCO_3$ alkalinity in the form of CO_2 gas during their initial conversion to bacterial solids. This will occur entirely in the first two cells where algae growth will be quite limited. It is, therefore, expected that this CO_2 will be stripped out of the water by the aeration process and released to the atmosphere. As the heterotrophic bacteria undergo endogenous respiration, they will release an equivalent of 396 mg/l $CaCO_3$ alkalinity as CO_2 gas and 95 mg/l $CaCO_3$ as ammonium bicarbonate. Approximately 60 percent of this respiration will occur in the first two cells where CO_2 stripping will occur; therefore, only 158 mg/l $CaCO_3$ alkalinity as released CO_2 and 95 mg/l $CaCO_3$ alkalinity as ammonium bicarbonate will be available for algae growth due to endogenous respiration. In addition, the introduction of 4200 SCFM of aeration into the third treatment cells will introduce 14 mg/l $CaCO_3$ alkalinity as CO_2 during the nine day detention period of the third cell.

Therefore, it would appear that there would be a total of 575 mg/l $CaCO_3$ alkalinity available for algae growth in the third cell. This would allow the growth of 140 mg/l of algal cells. However, the nitrification of the 28 mg/l of influent NH_3 plus an additional 9 mg/l ammonia released during metabolism of the influent BOD_5 would reduce the available alkalinity.

Consequently, the nitrification of 37 mg/l NH_3 will consume 264 mg/l of the 575 mg/l $CaCO_3$ alkalinity.

The degree of nitrification occurring depends upon the ammonia concentration, residence time of the nitrifying bacteria, and water temperature and the presence of adequate oxygen. For ammonia concentrations above 5 mg/l, the mean cell residence time needed for complete nitrification is described by the formulas:

$\theta = 1/u$

$u = 0.5e^{0.07(T-20)}$ for temperatures between 10 and 30 degrees C

$u = 0.25e^{0.15(T-10)}$ for temperatures between 3 and 10 degrees C

Where:

θ = solids retention, days
u = maximum net specific growth rate of nitrifying organisms, days^{-1}
T = operating water temperature, degrees C....

Given the predicted treatment cell operating temperatures ... it can be determined that sufficient aeration time will be available for complete nitrification for all but the month of January when approxmately 75 percent nitrification will occur.

The remaining 311 mg/l alkalinity will be available for algae growth. The metabolism of this alkalinity, mostly in the form of bicarbonates, by algae results in a pH shift upward with the production of carbonates from bicarbonates. The carbonates tend to raise the pH to a point where algae growth is curtailed. In natural water conditions no more than 50 percent of the bicarbonate alkalinity is available for metabolism. This means that only 155 mg/l alkalinity will be converted to algae cells producing a cellular concentration of 36 mg/l at a pH of 9-9.5 in the third treatment cell, assuming no settling of algae. At this high pH, any remaining ammonia will quickly volatilize, and any free phosphorus and iron will precipitate out as ferric hydroxy phosphate and calcium hydroxy phosphate. This will tend to produce an iron-limited situation where further algae growth in the storage reservoir will be eliminated. Even if iron is not limiting, the additional uptake of carbon dioxide from the atmosphere in the reservoir will result in an increase of only 4-5 mg/l algae, bringing the total algae concentration to 39-40 mg/l, again, assuming no settling.

As these algae are contained in the reservoir, they will continually undergo an aging process followed by die-off and reassimilation of nutrients by new algae cells. During respiration and die-off of cells, CO_2 is released to the water and some of it will be lost to the atmosphere. The result will be a gradual reduction in algae concentrations. In addition, the limited mixing in the third treatment cell and the storage reservoir will promote substantial settling of algae over time. While the effects of die-off and settling are difficult to predict exactly, an analysis of algae die-off and regrowth rates along with settling effects suggest an average reduction of algae cells in the reservoir of approximately 60 percent. This will result in a final algal concentration of 16 mg/l with a corresponding BOD_5 volume of 18 mg/l.

The EPA and State of Colorado are proposing effluent requirements, from the final reservoir, of 30 mg/l BOD_5, 30 mg/l TSS, and a fecal coliform limit of 200 colonies per 100 ml for the 30-day average. The seven-day maximum values proposed are 45 mg/l for BOD_5 and TSS and 400 organisms per 100 ml for fecal coliforms.

PILOT STUDIES

A pilot-scale simulation of the proposed system using two parallel pilot units was conducted from the end of June 1978 to November 10, 1978, by Dr. McKinney and Mr. Norouzina (graduate student) to develop information on the feasibility of the proposed aerated lagoon system and the validity of the concepts employed in developing the system approach. The results of these tests and the test data are summarized from two memoranda and reports prepared by Dr. McKinney (Reference: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado," by R.E. McKinney and M. Norouzian; and Memorandum entitled "Summary Results from Aerated Lagoon Pilot Plant for Northglenn, Colorado," by R.E. McKinney dated 3/30/79).

> The pilot plants were designed for a flow rate of two gallons per day. Air was supplied from a small portable air compressor fitted with a pressure reducer. The air flow rate was adjusted to 5 lpm to give an oxygen transfer rate comparable to that of the full scale system. The air diffusion system was a loop of small plastic tubing around each cell with small holes at regular intervals. Oxygen transfer tests were conducted on one of the pilot plants prior to start up.
>
> [Both] pilot plant[s] [were] fed domestic wastewaters from Lawrence, Kansas, since it had characteristics similar to those of Northglenn, Colorado. [Each] pilot plant was fed one gallon of wastewaters each morning and each afternoon on a batch basis. The feeding process consisted of drawing off one gallon of effluent from the third cell and wasting to the drain. One gallon of effluent was removed from the second cell and transferred to the third cell. One gallon of effluent was then removed from the first cell and added to the second cell. Finally, one gallon of domestic wastewaters was added to the first cell.
>
> The two pilot plants differed slightly. The first pilot plant had two wooden racks around the aerator at the beginning of the third cell to permit nitrifying bacteria to attach themselves in an effort to insure proper stability for nitrification. After 56 days of operation the ammonia nitrogen feed to the first pilot plant was increased by 30 mg/l to determine the effect of high nitrogen on this system. During the entire study the pilot plant was operated outdoors and was subjected to normal diurnal variations in temperature and sunlight... The study was terminated on the 10th of November when the weather began to approach winter.

The results of the study are shown in Tables 1 through 11 of the report prepared by McKinney and Norouzian, repeated here for convenience as Tables II-4 through II-14.

The two pilot plants were designated A and B with the three cells designated as 1, 2, and 3 with cell 1 having one-day retention, cell 2 having four-day retention, and cell 3 having nine-day retention.

> The temperature of the pilot plants averaged 16 degrees C although it ranged from a high of 33 degrees C in August to a low of 5 degrees C in October. Diurnal variations in temperature were quite significant since the pilot plant was small and was not insulated.
>
> The pH tended to increase through the first two cells and then decreased in the third cell. The change in pH is natural for algal lagoons where the growth of the algae results in an increased pH.
>
> The suspended solids actually increased initially through Cells 1 and 2 as a result of microbial growth. In Cell 1 the bacteria metabolized the soluble organics and increased the SS. In Cell 2 the algae resulted in an increase in SS. Cell 1 was always comletely mixed, forcing the SS to move from Cell 1 to Cell 2 in direct proportion to their growth. Initially, the SS were allowed to settle in Cell 2; but after about one month of data collection, a decision was made to complete mix the SS in Cell 2. SS were allowed to settle in Cell 3. Most of the suspended solids in the effluent from Cell 3 were algae cells.
>
> The dissolved oxygen concentration was more than adequate. There was sufficient DO for good bacterial growth and for nitrification as well as carbonaceous BOD satisfaction.
>
> The alkalinity decreased as nitrification increased. The oxidation of ammonia results in the destruction of alkalinity with a drop of 7.14 mg/l alkalinity for each mg/l. It should be recognized that denitrification results in an increase in alkalinity. The net change in alkalinity represents the balance between nitrification and denitrification.
>
> The COD data decrease in Cell 1 represented the actual oxygen uptake by the microbes in stabilizing the organic matter. The COD rise in Cell 2 was related to the production of organic solids as a result of algae. The increase in soluble COD through the three cells is related to the washing of organic matter off the bacteria. In effect, there is a small conversion of suspended solids to soluble solids with time. The increased soluble COD is nonbiodegradable....
>
> The BOD data indicated that the first two cells of both units gave similar results while the added wood surfaces in Unit A gave slightly better solids separation. The BOD is primarily related to the suspended microbes.

TABLE II-4
TEMPERATURE DATA (°C)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	23	17	17	18	17	17	18
7	21	21	21	21	20	21	22
10	21	23	24	24	23	24	24
13	23	32	32	33	32	32	32
16	29	28	29	30	29	30	30
22	25	16	16	16	17	16	16
Sept. 3	24	22	23	23	22	23	23
8	24	21	21	21	22	21	21
11	24	21	22	22	22	22	22
16	25	22	22	22	22	23	22
21	22	12	12	12	12	12	12
25	23	17	17	17	17	17	17
29	23	14	13	13	14	14	14
Oct. 7	23	7	6	6	7	6	6
13	23	10	8	9	10	8	9
18	23	10	9	9	10	9	9
22	26	17	16	16	17	16	16
27	24	6	5	5	6	5	5
Nov. 1	23	7	6	6	7	7	7
5	24	16	15	15	16	15	15
10	22	7	7	7	7	7	7

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-5
pH DATA

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	7.4	8.4	8.9	8.4	8.3	8.8	8.3
7	7.0	8.3	9.2	8.6	8.2	9.2	8.5
10	6.9	7.9	8.8	8.4	7.8	8.7	8.3
13	7.3	8.0	10.0	9.2	8.0	9.8	9.4
16	7.0	7.8	9.7	9.3	7.8	10.1	9.3
22	7.5	8.2	8.8	8.4	7.9	8.7	8.6
Sept. 3	7.6	8.1	8.0	8.7	8.0	7.9	8.7
8	7.4	7.8	7.0	8.3	8.0	8.0	8.3
11	7.7	7.5	8.7	8.4	7.5	8.1	8.4
16	7.2	7.6	8.7	8.1	7.7	8.3	8.7
21	6.7	7.9	8.8	7.4	7.8	8.1	8.4
25	7.6	8.0	8.9	8.5	8.0	8.8	7.9
29	7.3	7.8	8.9	8.6	7.9	9.0	8.8
Oct. 7	7.6	8.1	8.5	8.1	7.8	8.0	8.2
13	7.0	7.9	7.7	8.2	7.9	8.3	8.4
18	7.2	8.0	7.8	7.7	7.9	7.9	8.2
22	7.4	8.0	7.6	7.6	8.1	7.9	8.0
27	7.1	7.9	8.2	8.0	8.0	8.1	8.4
Nov. 1	7.1	7.8	7.8	7.5	8.2	8.2	8.5
5	7.4	7.8	7.2	7.0	8.0	8.1	8.2
10	7.1	7.9	7.8	7.5	8.1	8.2	8.2

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-6
DISSOLVED OXYGEN DATA (mg/l)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	0.8	9.2	9.5	9.2	9.4	9.8	9.5
7	1.0	8.3	9.4	9.2	9.4	10.5	10.0
10	1.4	7.1	8.3	8.3	7.4	8.3	8.3
13	1.2	6.9	7.5	7.7	6.9	7.8	7.8
16	1.0	6.1	7.1	7.2	6.3	7.2	7.6
22	1.0	8.0	8.8	9.1	9.0	9.2	9.0
Sept. 3	0.8	7.3	8.2	8.9	4.4	8.2	9.8
8	0.5	7.4	8.5	8.9	8.2	9.1	9.1
11	0.7	7.2	8.4	8.3	8.0	8.7	8.4
16	0.5	8.2	8.1	7.8	8.2	8.7	8.4
21	0.5	9.1	9.8	9.6	9.5	9.8	9.6
25	0.4	8.3	9.4	9.4	9.0	10.1	9.3
29	0.4	8.8	9.5	9.8	9.7	11.5	11.0
Oct. 7	0.3	8.9	9.8	10.0	11.4	12.0	11.4
13	0.0	9.8	9.8	9.4	9.0	10.0	9.6
18	0.0	9.0	9.5	9.6	9.4	10.0	9.5
22	0.0	7.0	7.1	6.8	7.4	7.5	6.6
27	0.0	9.5	9.8	10.4	10.0	10.3	10.1
Nov. 1	0.0	10.5	12.5	11.2	11.0	12.0	12.1
5	0.0	9.8	11.0	11.0	10.0	10.9	12.0
10	0.0	9.5	10.6	10.4	10.6	11.4	11.2

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-7
TOTAL SUSPENDED SOLIDS DATA (mg/1)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	110	250	4	10	260	22	22
7	160	290	8	15	240	32	22
10	210	310	16	22	280	26	23
13	150	160	12	28	140	22	29
16	340	290	5	19	310	10	22
22	140	170	5	10	170	6	22
Sept. 3	190	180	560	23	170	1060	58
8	270	250	850	23	270	73	73
11	220	260	760	15	210	640	120
16	170	190	610	13	240	640	100
21	180	290	510	31	160	480	130
25	410	300	500	42	270	520	230
29	360	240	590	52	190	600	90
Oct. 7	140	260	560	33	260	510	160
13	370	420	360	44	360	470	11
18	170	240	420	42	270	470	27
22	290	210	360	120	210	370	15
27	240	260	370	320	280	390	280
Nov. 1	170	260	370	140	280	340	150
5	190	200	260	140	170	280	340
10	320	360	330	280	380	350	220

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-8
VOLATILE SUSPENDED SOLIDS DATA (mg/1)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	100	170	2	10	190	20	19
7	150	210	2	8	160	22	15
10	170	230	6	13	200	16	16
13	120	120	4	17	100	10	18
16	270	230	3	17	240	6	20
22	110	140	3	7	140	5	20
Sept. 3	130	140	370	14	120	650	48
8	190	160	570	14	170	63	63
11	180	200	340	9	46	416	97
16	120	120	420	5	130	360	86
21	120	190	380	21	170	320	120
25	260	210	340	35	190	370	180
29	270	170	450	46	140	430	76
Oct. 7	110	200	410	26	200	390	130
13	300	310	270	37	270	350	7
18	22	180	310	31	200	360	20
22	190	64	270	92	150	270	10
27	180	200	280	240	210	280	220
Nov. 1	120	180	270	100	200	250	120
5	120	140	180	120	130	210	230
10	230	260	240	210	280	240	180

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-9

5-DAY BIOCHEMICAL OXYGEN DEMAND DATA (mg/l BOD_5)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	140	100	5	4	100	10	13
7	180	120	11	23	130	31	30
10	330	110	3	8	94	9	21
13	200	110	10	10	140	15	13
16	190	110	6	7	140	6	6
22	200	110	72	23	120	70	45
Sept. 3	140	85	150	18	78	160	75
8	190	68	120	15	68	60	60
11	80	64	100	9	66	110	57
16	96	60	93	15	59	75	37
21	100	110	62	25	75	68	20
25	110	78	65	29	70	68	40
29	210	83	86	31	72	70	40
Oct. 7	110	98	140	14	95	92	35
13	300	120	98	14	110	100	6
18	160	97	110	14	91	110	14
22	150	100	110	32	100	120	12
27	130	100	95	54	100	93	44
Nov. 1	200	110	110	32	120	120	35
5	100	84	70	34	62	75	76
10	210	160	140	56	150	92	70

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-10

TOTAL CHEMICAL OXYGEN DEMAND DATA (mg/l COD)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	370	310	60	100	290	65	90
7	460	300	60	98	270	75	67
10	640	350	59	85	360	69	90
13	260	300	70	100	260	74	95
16	640	280	55	110	370	48	99
22	330	310	22	80	310	53	100
Sept. 3	390	270	580	110	240	-	270
8	560	310	750	110	290	280	270
11	260	280	520	90	280	550	280
16	360	240	410	80	390	470	200
21	460	360	360	69	340	480	140
25	480	360	570	170	330	500	240
29	610	260	390	140	260	910	160
Oct. 7	370	350	400	110	360	810	160
13	600	510	320	120	440	360	42
18	510	350	500	110	350	530	60
22	490	310	460	200	320	460	71
27	500	400	480	460	420	490	450
Nov. 1	470	330	430	220	360	400	220
5	390	300	360	250	250	250	570
10	600	420	480	380	480	430	570

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-11

SOLUBLE CHEMICAL OXYGEN DEMAND DATA (mg/l COD)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	110	120	45	70	40	35	60
7	260	67	50	65	40	43	37
10	310	150	8	63	33	47	49
13	88	45	58	68	41	56	74
16	210	48	55	69	27	41	75
22	120	13	13	25	80	47	38
Sept. 3	140	67	94	110	47	78	59
8	200	54	58	100	48	220	210
11	4	70	70	71	47	60	160
16	120	88	53	66	51	47	160
21	240	42	46	50	56	46	85
25	65	38	54	73	38	54	84
29	130	55	55	70	51	55	91
Oct. 7	160	58	50	58	54	46	62
13	140	49	44	61	57	46	40
18	180	49	53	53	56	51	60
22	170	52	45	75	63	78	52
27	160	47	51	51	47	47	55
Nov. 1	240	47	51	59	51	51	55
5	160	58	45	56	50	50	46
10	260	50	46	50	50	46	61

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-12

ALKALINITY DATA (mg/l as $CaCO_3$)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	210	130	100	80	140	110	80
7	160	160	64	48	160	67	50
10	180	160	150	100	170	150	110
13	200	150	130	120	160	130	120
16	200	120	120	140	120	120	140
22	190	160	150	130	150	150	140
Sept. 3	170	110	80	92	120	87	94
8	200	130	62	110	140	110	110
11	200	80	70	110	78	72	120
16	190	85	86	120	100	82	120
21	190	140	90	94	150	94	100
25	220	120	110	120	130	110	110
29	210	120	110	130	120	110	120
Oct. 7	210	140	120	140	140	120	130
13	180	130	46	92	130	93	130
18	200	140	67	52	130	97	130
22	230	140	75	55	160	110	140
27	200	150	83	48	160	110	140
Nov. 1	200	130	51	30	140	69	130
5	200	100	23	17	120	69	130
10	200	140	60	23	150	83	120

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-13

AMMONIA-NITROGEN DATA (mg/1 NH_3-N)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4							
7							
10							
13							
16							
22							
Sept. 3	12	5.8	0.6	0.1	8.0	1.2	0.1
8							
11	22	10.7	0.6	1.1	10.3	0.5	1.3
16	20	15	0.1	0.1	16	0.1	1.0
21	25	7.0	0.8	0.6	8.0	1.0	1.3
25.	1.7	10	1.0	0.5	12	0.4	0.7
29							
Oct. 7	30	50	5.0	0.0	10	1.8	0.0
13	27	70	32	0.7	11	0.9	0.7
18	30	60	40	0.5	15	2.5	5.0
22	38	75	51	14	24	3.5	3.0
27	38	80	61	28	25	12	0.8
Nov. 1	32	74	48	23	16	2.0	0.9
5	23	60	42	27	9.0	0.3	1.5
10	26	60	48	23	15	1.6	1.4

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

TABLE II-14

NITRITE AND NITRATE NITROGEN DATA (mg/1 NO_2 + NO_3-N)

Date	RAW	A-1	A-2	A-3	B-1	B-2	B-3
Aug. 4	1.1	13	0.5	21	21	21	21
7	1.0	7.0	0.5	0.5	6.5	0.5	0.5
10	1.5	7.0	0.5	0.5	6.0	0.5	0.5
13	0.8	11	0.5	0.5	7.7	0.5	0.5
16	0.7	12	0.5	0.5	12	0.5	0.5
22	0.6	11	0.5	0.5	11	0.5	0.5
Sept. 3	1.0	10	6.0	0.5	7.5	5.0	0.8
8	0.8	9.5	8.0	0.5	6.7	9.5	1.0
11	0.7	26	7.5	0.5	24	6.0	1.0
16	0.5	20	6.0	0.5	16	7.0	1.0
21	0.9	3.7	3.8	0.9	3.0	4.3	0.6
25	0.4	20	3.0	0.5	16	3.0	0.3
29	0.6	16	5.1	0.3	7.0	4.0	0.2
Oct. 7	0.7	10	5.5	0.5	10	5.0	0.3
13	1.0	10	10	1.0	8.0	8.0	7.0
18	1.5	7.5	7.0	0.5	8.0	7.0	9.0
22	0.8	9.0	4.0	6.5	6.5	5.0	0.6
27	0.8	7.0	9.0	8.7	6.5	12	1.8
Nov. 1	1.1	8.5	14	14	8.0	19	2.0
5	0.8	13	13	11	10	13	0.9
10	1.0	5.1	12	9.5	4.8	13	2.5

SOURCE: "Aerated Lagoon Pilot Plant Study for Northglenn, Colorado", R.E. McKinney and M. Novouzian, June 1975.

The ammonia nitrogen decreased through the three cells as result of nitrification and synthesis of algal protoplasm. The B Unit showed almost 90 percent reduction in total nitrogen. Increasing the nitrogen in Unit A showed a definite reduction in nitrogen. Unfortunately, the low temperature in October and November resulted in incomplete nitrification.

ANALYSIS OF CONCEPTS AND STUDIES

This section presents the analysis of the concepts of treatment and the capabilities of the proposed system. These analyses represent the results of an independent analysis of the proposed concepts, data base, treatability studies, and other items supplied by Shaeffer and Rolands, Inc. These analyses will be further divided into subsections on sufficiency of raw waste load data, treatability studies, BOD_5 removal and discharge, TSS removal and discharge, nitrification, algae growth and the limitation of such growth in the reservoir, and an evaluation of the capability of the proposed system to fully meet proposed effluent requirements for BOD_5 and TSS. A separate section will be devoted to an analysis of the capability of the system to meet the fecal coliform requirements, the applicability of these requirements, and the implications of the reservoir effluent in terms of potential public health problems.

Raw Waste Load Data

As several of the documents and memoranda between Dr. McKinney and Sheaffer and Roland, Inc. indicated, the development of a good data base describing the raw waste loads expected in the proposed system is essential to the success of attaining full-scale operation as described in the proposed concepts. This is particularly true in the case of the relationships between nitrification, ammonia levels, alkalinity, the ability to achieve a carbon limiting system in the reservoir, and ultimately the degree and potential for algae growth sufficient to exceed effluent permit standards.

The data used in developing the design of the Northglenn system consist of a series of samples representing one 13-day period in February and March 1978. These data are presented in Table II-15. This data base may not be sufficient for the system proposed for the following reasons:

TABLE II-15
WASTEWATER CHARACTERISTICS

Total BOD_5	200 mg/l
Soluble BOD_5	60 mg/l
Total COD	220 mg/l
Soluble COD	80 mg/l
Suspended Solids	190 mg/l
Volatile Solids	220 mg/l
Total Solids	720 mg/l
Dissolved Solids	530 mg/l
pH	7.2
Alkalinity	340 mg/l as $CaCO_3$
Total Iron	0.9 mg/l
Sulfates	160 mg/l
Sulfides	0.2 mg/l
Total Sulfur	54 mg/l
Sodium	135 mg/l
Potassium	20 mg/l
Calcium	100 mg/l
Magnesium	11 mg/l
Chlorides	80 mg/l
Kjeldahl-N	65 mg/l
Ammonia-N	35 mg/l
Organic-N	30 mg/l
Total Phosphorus	20 mg/l
Cadmium	<0.01 mg/l
Zinc	0.03 mg/l
Molybdenum	<0.01 mg/l
Chromium	<0.02 mg/l
Lead	<0.01 mg/l
Copper	<0.01 mg/l
Boron	<0.01 mg/l
Nickel	<0.01 mg/l
Selenium	<0.01 mg/l
Arsenic	<0.02 mg/l

SOURCE: Ross E. McKinney memo of 4/4/78 entitled "Proposed Aerated Lagoon for Northglenn, Colorado".

(1) The data do not represent year round operation in terms of changes in key parameters such as ammonia-nitrogen concentrations, alkalinity levels, etc.

(2) Due to the abnormally high (for municipal wastewaters) ammonia and total Kjeldahl-nitrogen (TKN), additional sampling should have been conducted to assure the accuracy and representativeness of those values.

(3) Sampling of the proposed supplementary water sources, storm water runoff, irrigation return water, and especially the new source of potable water should have been carried out to determine if the ammonia-nitrogen:alkalinity ratio would be changed when water from the City of Thornton water is no longer used. In addition, the quantities of ammonia and the alkalinity levels in the storm water runoff and irrigation return flows have not been considered in developing the overall system concept. The effect of these may be considerable, especially during periods of peak flow and so could cause considerable changes in the overall ammonia-nitrogen:alkalinity ratio.

Pilot Plant Treatability Studies

The pilot plant studies were carried out in a very professional manner. The data which were collected and the results appear to be consistent with other similar studies. Several potential concerns regarding the relationships of these studies to the Northglenn situation are:

(1) Lawrence, Kansas, wastewater, not Northglenn wastewater, was used. Differences in the ammonia and alkalinity relationships between these two sources were not considered.

(2) There was insufficient run time during cold weather. Cold-weather operation is critical in aerated lagoons due to the long detention times and low rates of biological activity. This is especially true for extreme cold weather such as that experienced in the Denver area.

(3) No documented attempt to simulate the storage reservoir conditions was performed. Although one test using effluent from the pilot plant in a glass carboy placed in the sun did not produce significant algal growth, according to a verbal report from Dr. McKinney, the long-term effects of material carryover and other nutrient sources to the proposed reservoir were not adequately considered.

In summary, the pilot plant tests are valuable in terms of evaluating the level of performance which should be achieved by the Northglenn system. However, care must be taken to recognize the limitations of the pilot studies in terms of their direct comparability to the Northglenn project.

Five-day BOD Removal Analysis

The removal of BOD_5 from municipal wastewaters by aerated lagoon systems such as those proposed for Northglenn may be characterized as follows:

(1) During the summer, essentially complete removal of soluble BOD_5 should be expected and most of the insoluble BOD_5 in the influent should be assimilated or removed by sedimentation. The main contributors to BOD_5 in the effluent from the third cell of the aerated lagoon should be from microbial suspended solids and algae which have not settled out. Microbial solids at this point may be expected to contribute approximately 0.2 to 0.5 pounds of BOD_5 per pound of solids. The BOD_5 which can be attributed to algal cells can be as low as almost zero (no die-off) to an excess of one pound of BOD_5 per pound of algae. If the TSS from the third aerated lagoon can be controlled during the summer, then the effluent BOD_5 load to the reservoir should be quite low. Should the expected high flow rates of up to 13.1 million gallons per day occur for extended periods during the summer, the increased mass loading of BOD_5 coupled with the decreased treatment efficiency due to much shorter detention times may lead to relatively high carryover

of BOD_5 into the reservoir. Should this occur during a dry year when the reservoir is at minimum storage volume then the BOD_5 in the reservoir could rapidly approach the level of the lagoon effluents.

(2) The BOD_5 in the effluent from the reservoir will be predominantely affected, in the summer, by the algae population in the reservoir as this should be the main source of BOD_5. However, minor amounts of BOD_5 may be present from other sources and some minimal background level not associated with algal cells should be anticipated.

(3) During the winter, the efficiency of the aerated lagoons in removing BOD_5 will be significantly reduced. As the pilot studies performed by Dr. McKinney and Mr. Norouzian indicated (October 7, 1978, through November 10, 1978), as the first-stage lagoon temperature dropped to about 10 degrees C, the BOD_5 removal in the first cell was reduced from about 45 percent (at an average first-stage temperature of 20 degrees C) to 36 percent (at an average first-stage temperature of 10 degrees C) in System A and from 44 percent to 38 percent in System B. Overall BOD_5 removals for all three cells over the two periods was from 90 percent removal to 80 percent removal for System A and from 78.9 percent to 78 percent in system B. The removals in System B are masked by high TSS (and related BOD_5) carryover in the effluent during the warm period of the study. Even more important may be the last few days of the pilot plant operation when the cold weather (5 to 7 degrees C) brought about effluent BOD_5 concentrations of 50 mg/l to 70 mg/l and above in the third-stage lagoon effluents. Compounding these factors is the possibility for peak flows due to runoff during the critical cold-weather months. The impact of such high flows and associated additional BOD_5 loads would be to reduce effluent quality and BOD_5 removals even further due to higher BOD_5 loading rates and reduced aeration times in the lagoons.

(4) The negative effects of cold weather operation on BOD_5 removal for the Northglenn project may be even more pronounced as the estimated wastewater temperatures for these lagoons are estimated to go down to about 10 degrees C in the first stage and 6 to 7 degrees C and below in the second and third stages for up to three to four months of the year. Ths may be expected to cause a serious reduction in BOD_5 removal from the lagoons leading to high BOD_5 carryover into the reservoir. If such carryover continues at high enough BOD_5 concentrations and for a long enough period of time, the quality at the effluent from the reservoir may be adversely affected.

TSS Removal Analaysis

The TSS removals and the effluent TSS from the proposed Northglenn aerated lagoon system and reservoir can be divided into two major operational periods representing summer (warm weather) and winter (cold weather) operation.

(1) Winter operation for aerated lagoon systems with quiescent settling ponds is typically not critical in terms of effluent TSS. The TSS results obtained in the pilot studies, high effluent TSS from the third-stage lagoons following cold temperatures, are probably due to the following factors. The low temperatures caused reduced BOD_5 removals in the first two stages of the lagoons which increased the loading on the third stage. This increase in loading probably resulted in the growth of additional microbial biomass in the third cells. This additional biomass would be relatively disperse growth which, due to the pilot plant mixing, would tend to find its way into the effluent. This effect would have little impact on the Northglenn project as the quiescent settling provided by the reservoir would mitigate the high solids. However, this could lead to large quantities of organic carbon being deposited in the reservoir which could seriously affect the capabilty of maintaining a carbon limiting system in the

summer months when algal growth levels will be critical in terms of permit TSS compliance.

(2) Summer operation will be the critical period for the Northglenn project in terms of compliance with effluent TSS permit limitations. If the algal growth in the reservoir and the carryover of algal growth from the aerated lagoons to the reservoir can be adequately controlled, permit compliance may be achievable. The ability to maintain a carbon limiting system in the reservoir is, however, suspect due to BOD_5 and TSS carryover during cold weather operation, transfer of carbon dioxide from the atmosphere to the reservoir, high effluent TSS concentrations from the lagoons in the summer (characteristic of aerated lagoon systems) due to algal growth and third-stage mixing, and loss of nitrification during cold weather operation leading to alkalinity carryover into the reservoir. In addition to the potential algae growth, the problem of higher than normal (near peak) inflows during the summer carrying high sediment loads may impact the reservoir effluent TSS.

Analysis of Nitrification

The importance of nitrification to the operation of the Northglenn project is related (in terms of permit compliance) to the removal of alkalinity and the subsequent ability of the proposed system to maintain a carbon limiting condition for algal growth in the final reservoir. Based on the pilot studies performed, literature sources, and experience with various systems achieving, or attempting to achieve, nitrification, there is considerable risk that the proposed Northglenn treatment system will not be able to attain the necessary nitrification performance to eliminate the available alkalinity in the wastewaters.

Several factors mitigate against achieving noticeable nitrification during winter operation of the proposed Northglenn system. The major problem will be low temperatures in the second and third stages where most nitrification is expected to occur. The temperatures

projected for these stages in the winter (less than 7 degrees C for three months in cell number 2 and less than 2 degrees C for three months in cell number 3) is insufficient to maintain adequate nitrification, as shown in Figure II-1 excerpted from the "Process Design Manual for Nitrogen Control" from EPA's Technology Transfer Series. As this figure indicates, at temperatues of 7 degrees and below, nitrification rates are generally about 30 percent or less of the rate achieved at 20 degrees C and only 10 percent of the rate achieved at 30 degrees C. As the temperature drops and the rate of growth of the slow-growing nitrifiers is reduced even further, there is considerable chance of losing all nitrification. This is especially true for an aerated lagoon system where the recycling of solids cannot be used to attain high sludge age. Should the aerated lagoons for whatever reason experience a solids washout at the beginning of cold weather, this effect will be even more pronounced.

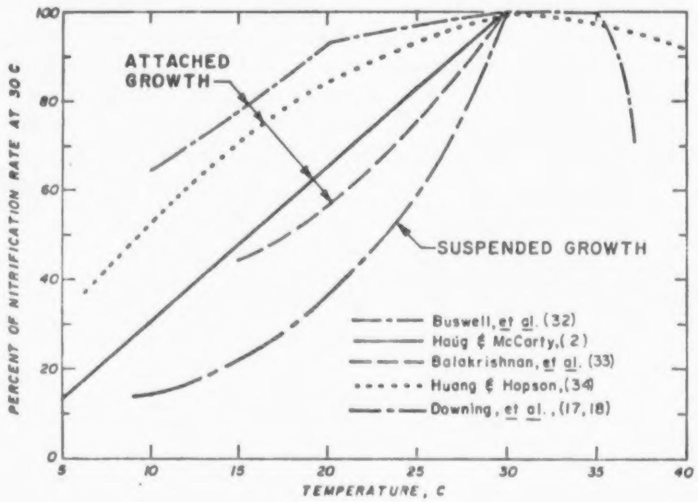
The second factor which may affect the nitrification during the cold weather is the additional carbonaceous BOD_5 which will be applied to the second and third cells of the aerated lagoon due to lowered removal efficiencies. The ability to achieve desirable nitrification results is much more difficult in systems where the carbonaceous oxygen demand is still high. If the full-scale aerated lagoons are only able to achieve effluent BOD_5 levels of 40 to 50 mg/l during cold weather, as the pilot systems did, this could further mitigate against the ability to maintain the high levels of nitrification projected for the system.

RELATIONSHIP OF FIVE-DAY BOD REMOVAL, TSS REMOVAL, NITRIFICATION, AND ALGAL GROWTH IN THE PROPOSED BULL CANAL RESERVOIR

The ability of the proposed Northglenn system, three-stage aerated lagoons and storage reservoir, to meet effluent TSS requirements will probably be dependent on the abilities of the system to inhibit algae growth in the final reservoir. To do this, it is proposed that a complex series of reactions and dependencies intended to maintain a carbon limiting system in the final reservoir be used. No controls of nitrogen

FIGURE II-1

COMPARISON OF EFFECT OF TEMPERATURE ON NITRIFICATION IN SUSPENDED GROWTH AND ATTACHED GROWTH SYSTEMS



or phosphorus are proposed and Northglenn's engineers recognize that sufficient amounts of these nutrients will be available to sustain large algal growths.

The ability of the system to be maintained in the carbon limiting conditions proposed is dependent upon a multitude of factors, the most important of which are: (1) complete nitrification in the aerated lagoons and the attendant removal of essentially all alkalinity from the wastewaters; (2) that the raw waste will have, on a continuous basis, 30 to 35 mg/1 ammonia-nitrogen, as shown by the two weeks of raw waste load data obtained; (3) essentially complete removal of carbonaceous BOD_5 by the aerated lagoons; and (4) exceptionally low, for aerated lagoons, effluent TSS from the lagoons to the reservoir.

Based on the previous analyses of the data base, attainable removals, and attainable nitrification, there is considerable risk that these conditions can be achieved consistently. The high potential for BOD_5 losses in the 30 to 50 mg/1 range or above in the winter, the high potential for low nitrification rates and thus high alkalinity during winter operation, the carryover of TSS (containing carbon) from the lagoons to the reservoir, and the direct transfer of carbon dioxide from the atmosphere to the reservoir will all combine to make it very difficult to maintain the desired conditions in the reservoir. During the critical summer periods, the high influent flow rates (up to 13.1 million gallons per day) composed of return flows may not have the correct ammonia-nitrogen:alkalinity ratios and could conceivably lead to excessive alkalinity levels in the reservoir, especially during dry years when the reservoir pool is at minimum volume. The long-term effects of BOD_5 and TSS carryover into the reservoir will be to build up a substantial carbon source within the reservoir which could be made available for algal growth under the right conditions (windy days, spring turnover, reservoir mixing, release of nutrients to the water column by endogenous respiration of orgnic solids, etc.). All of the factors mentioned combine to make the prospect of attaining carbon limiting conditions in the reservoir appear as a marginally attainable prospect.

The argument is also made by Sheaffer and Roland and Dr. McKinney that should algal growth occur, the low alkalinity available would lead to high pH levels in the reservoir. Such high pH condition could then lead to ammonia-nitrogen loss due to stripping and precipitation of iron and phosphorus and a limit to algal growth due to a shortage of these necessary nutrients. To achieve any reasonable removal of ammonia-nitrogen, the pH would have to well above 9, which is the upper limit for permit compliance. Thus, pH adjustment would be required before discharge. In fact, should the pH increase, this would lead to additional carbon dioxide transfer from the atmosphere which would tend to lower the pH and increase the available carbon for algal synthesis. The prospect of removing enough phosphorus or iron to prove limiting to algal growth seems likewise unlikely at the pH values of 9 to 10 which might occur.

ATTAINABILITY OF PERMIT REQUIREMENTS

As the foregoing discussions and analyses indicate, several factors will combine to make 100 percent permit compliance by the Northglenn system difficult to achieve. The probability that the proposed Northglenn system will meet all required effluent BOD_5 limitations is high. Summer operation should not present a problem in terms of BOD_5 unless very high contributions for algal growth are encountered. Cold weather operation could prove a problem if sufficiently cold weather attenuates BOD_5 removal in the aerated lagoons for a long enough period of time. However, with the long detention in the reservoir, this possibility is rather remote.

The probability that the proposed system will meet all effluent TSS requirements is, however, rather low. The maintenance of the carbon limiting conditions in the reservoir for algae control appears rather and thus the potential for large summer growths of algae in the reservoir is quite high. It cannot be unequivocally stated that the proposed system will not meet the required effluent TSS limitations; however, the probability of exceeding the effluent TSS limitations appears quite high.

FECAL COLIFORM REQUIREMENTS AND DISCUSSION

The proposed fecal coliform limitations by the State of Colordo for the Northglenn project are 1,000 colonies per 100 ml for the 30-day average and 2,000 colonies per ml for the seven-day average. EPA, however, will require modifying these to 200 colonies per 100 ml for the 30-day average and 400 colonies per 100 ml for the seven-day average.

The 1,000/2,000 limitations will be considered first. It has been demonstrated in many systems that excellent removals of fecal coliforms can be achieved by long detention time.lagoon systems. It is probable that most if not all of any fecal coliform contamination found in the proposed Bull Canal Reservoir effluent will be from sources other than the influent wastewaters. Only very special circumstances such as complete loss of biomass in the aerated lagoons or severe short circuiting in the reservoir could produce excessive effluent fecal coliform contamination due to the influent wastewaters. The proposed Northglenn system will have chlorination facilities for the reservoir effluent. It is proposed that these facilities will be used on an as-required basis. For the proposed limit of 1,000/2,000 colonies per 100 ml, it should be only under rare circumstances that the use of these facilities would be required.

The 200/400 colonies per 100 ml limitations required by EPA will be more difficult requirement. These limits will probably require chlorination of the effluent for considerable periods if not all the time in order to be met. At these low levels, such things as contamination from ducks, geese, and other water birds as well as other natural sources may be enough to cause violation of the proposed limits. Under these circumstances, the probability of excessive contamination being due to the influent wastewaters is rather remote.

COMMENTS CONCERNING FECAL COLIFORM LIMITATIONS

The following text is excerpted from a memorandum by Dr. E.F. Gloyna concerning the "Mortality Rate Estimates for Disease Causing Agents in Domestic Wastewater." This memorandum was prepared by Dr. Gloyna in response to a request by EPA that Dr. Gloyna address the question of disease-causing agents and the potential for the creation of public health problems due to the use of the effluent from the proposed Northglenn project for food crop irrigation and direct human contact with Bull Canal reservoir effluent.

Because of the variety of disease-causing agents and the multiplicity of environmental factors involved, there is no simple and universally usable technique for predicting specific pathogenic agents in a secondary biological wastewater treatment plant or an individual waste stabilization pond. Some environmental factors that cause a decrease in bacterial concentration are; dilution and mixing, aggregation, presence of toxic substances, predation, sunlight, temperature, and availability of nutrients.

Some potential waterborne diseases include bacillary and amoebic dysentery, salmonellosis, leptospirosis, cholera, vibriosis, and infectious hepatitis. Other less common diseases are brucellosis, ascariasis, schistosomiasis, ancylostomiasis, and tapeworm disease. Epidemiological evidence from other countries indicates that reuse of domestic wastewaters, particularly for crop irrigation, has resulted in disease outbreaks. However, the reuse of treated wastewater in California has not resulted in any confirmed disease outbreaks [1].

The transmission of pathogens by etiological agents such as bacteria, protozoa, helminths, and viruses are of concern but the possible detection of individual pathogenic agents is usually through some indicator microorganism such as E. coli.

Effective removal of enteric microorganisms is related to the retention of settleable material detention of the liquid, availablity of nutrients, and a host of environmental factors.

The degree of risk in water reuse always raises questions. It appears that 100 percent removal efficiency of pathogens is neither economically practical nor technically attainable, the concept of "acceptable risk" is the only realistic approach for grappling with environmental health questions. In the absence of adequate epidemiological data to evaluate the potential health hazard from pathogens applied to soil, monitoring for the occurrence of the pathogens in the environment must be the primary health measure.

Removal of Organisms

In studies conducted at The University of Texas at Austin, it was established that a considerable reduction in coliform organisms is achieved by the passage of wastewater through waste stabilization ponds as shown by:

(a) Average percent reduction of coliform organisms in all tests performed was 99.4 plus or minus 0.74, relative to the initial population in the first section at a theoretical detention time of 11.4 days. Percentages based on averages of all tests and geometric means were similar.

(b) Average percent reduction of total number of bacteria was 88.8 plus or minus 21.85 relative to the initial population in the first section at the theoretical detention period of 11.4 days. Percentages based on averages of all tests and geometric means were similar.

There is a general attitude that waterborne disease outbreaks of epidemic proportions have, to a great extent, been controlled; however, the potential for disease transmission through the water route has not been eliminated. It is assumed that disease organisms of epidemic history are still present in today's sewage, and the status of control is more one of severence of the transmission chain than a total eradication of the disease agent. For example, vegetable decontamination studies have indicated that washing vegetables even with detergents is ineffective in removing bacteria and helminth eggs. The latter are also extremely resistant to chemical disinfectants. Thus, in the case of edible food, emphasis should be placed on either eliminating the pathogenic agents from the wastewater prior to irrigation or preventing direct contact between the wastewater and the edible portion of the crop to minimize the risks of disease transmission.

However, it must be recognized that pathogens are destroyed or removed from untreated wastewaters during treatment processes. Settleable entities such as cysts and worms will settle out and become incorporated in the bottom sludges. Virus particles are largely associated with suspended solids. Thus, removal of original solids from wastewaters, extensive biological stabilization, elimination of short-circuiting and long hydraulic detention will enhance the reduction of certain disease-causing agents in the treated effluents.

The following paragraphs summarize selected studies. Emphasis is directed to the importance of polishing or holding ponds, although it is recognized significant settling and reduction of pathogens will take place in preceding primary clarification, aerobic/anaerobic lagoons. A log-log linear relationship was found between the total plate count (TPC) and the most probable number (MPN) of colfiorms with a coefficient of correlation of 0.78. Die away of coliform organisms was at a higher rate than total bacterial population.

Listed below are summary statements provided in a World Health Organization Monograph: [3]

(a) In small waste stabilization pond, 0.4 ha in area and with operating depths ranging from 80 cm to 1.5 m, organic loading rates of 22, 45, 67, 90, and 112 kg BOD_5 per hectare per day, flow rates from 600 to

1050 m^3 per day, and temperature ranging from 2 to 33 degrees C, the MPN reached the highest levels in the ponds receiving the heavier loadings and operating with the shorter detention times. Coliform removal rates varied only in the third and fourth significant figures. No pond failed to remove less than 99.99 percent of coliform bacteria during any month in which measurements were taken.

(b) Field studies have shown that large-scale ponds (tertiary ponds) are particularly effective in reducing fecal E. coli. The success of maturation ponds as a buffer against environmental bacterial pollution has been clearly stated.

"Although a faecal E. coli count of nil per 100 ml cannot always be obtained in maturation ponds, the degree of safety (as indicated by faecal E. coli count) that can be obtained is comparable with that attainble in practice, where sand filtered effluent is chlorinated."

(c) The London Metropolitan Water Board reports that tertiary pond treatment of effluents from conventional secondary sewage treatment plants reduced E. coli by 99.5 percent. A detention time of 8 days is recommended.

(d) Similar experiences have been recorded in Australia where detention times of 30-40 days in multiple ponds were shown to reduce the number of coliform organisms to levels approaching those found in drinking water. Of course, other factors besides coliform density must be evaluated before treated wastewaters and drinking waters can be compared.

(e) Studies in Auckland, New Zealand, showed that over 99 percent of the coliform organisms were removed in waste stabilization pond.

(f) In Israel, coliform removal rates of about 99 percent have been reported in two ponds connected in series having a total detention time of 26 days. The average BOD_5 reduction was 87.4 percent from an initial BOD of 283 mg/l. Unsatisfactory coliform reduction was obtained with a detention time of only 3.5 days.

(g) In laboratory studies involving Salmonella abortus equi the die-away rate was found to be dependent on temperature, initial organism density, and availability of nutrients. The reduction was primarily due to competition for food. In a field experiment with the same organism, under summer temperature conditions (25 degrees C), the number of organisms per ml was below the sensitivity of analyses within 72 hours.

(h) Field studies in India showed that species of salmonella were present in the influent, but not in the effluent, of facultative ponds. However, coliform organisms, E. coli, and streptococci were reduced by only 89-92 percent, 81-91 percent, and 84-85 percent, respectively. Under the tropical conditions prevailing, it was possible to achieve 72 percent reduction of BOD_5 with a loading of 450-560 kg/ha per day. The pond depth was 1.2 m, and the detention time only 2 days per pond. Aeration was applied below the pond surface for 1 hour in the morning and 2 hours in the evening.

(i) Also, in India, studies showed that the die-off rate of Mycobaterium turberculosis is high. Domestic wastes mixed with sanatorium wastes were treated in a septic tank and then in a waste stabilization pond. Acid-fast bacteria were found in about 50 percent of the samples of untreated waste and in about 25 percent of the samples of septic tank effluent, but not in samples taken from the pond and the pond effluent.

(j) Test conducted in Isreal showed that cysts of Endamoeba histolytica could be found in pond influents but never in the effluents.

(k) Studies conducted in South-west Africa showed that 18 percent of entero and reovirus were not removed after secondary settling. However, a 95 percent additional reduction was achieved by the biological purification in nine, series-connected polishing ponds, having a total hydraulic loading of 14 days. The $TCID_{50}$ (50 percent tissue culture infective dose) in the influent to the wastewater treatment plant reached levels of 20,000 $TCID_{50}^{-1}$.

Increasing attention has been given to the transmission of viral diseases through water reuse. Waterborne outbreaks of infectious hepatitis have clearly been associated with the ingestion of wastewaters. Identification and enumeration of viruses in water and wastewater has been hampered by the limitations of sampling techniques, problems of concentrations of samples, the complexity and high cost of laboratory procedures, and the limited number of facilities having the personnel and equipment necessary to perform the analytical service.

Inhibition of Bacteria by Algae

Tests conducted with pathogenic bacteria and algal cultures yielded results similar to those found when enteric bacteria were used. Escherichia, Pseudomonas, and Serratia exhibited aftergrowth potential while Proteus, Alcaligenes, Enterobacter, Salmonella, Shigella, and Vibrio did not. Quantitative data have been obtained which demonstrate the effect of representative algal species on selected enteric bacteria. The data show that individual algal species exert little influence on an increase of the die-off rates. Laboratory and pilot-scale field tests provided similar results. The die-off coefficients for enteric bacteria were similar for tests conducted in the laboratories using mixtures of axenic algal cultures and in the field using pilot-scale waste stabilization ponds.

Others have found similar results [6]. It has been reported that relatively few contaminant bacteria will develop in vigorously growing algal cultures. It has been shown that most solid and air bacteria do not survive when placed into axenic algal cultures. Such inhibition of bacterial growth by algae has been attributed primarily to antibiotic substances that are liberated by algae. It was found that Chlorella inhibited the growth of bacteria and antibacterial substances were found in filtrates of Chlorella pyrenoidosa, Chlorella vulgaris, Scenedesmus quadricauda, and Chlamydomonas reinhardti. Bacteriostatic substances have also been reported for Oscillatoria splendida, Stichococcus bacillaris, and Prosiphon botryoides. The BOD of clear supernatant after Chlorella-bacterial growth has been shown to be higher than with Euglena. Some factor from Chlorella seems to inhibit bacterial action on municipal wastewater substrates. In addition to antibacterial substances, algae may indirectly inhibit bacterial activity by raising the pH of the water during periods of intense photosynthesis.

References

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(5) Davis, E., and Gloyna, E. "Bacterial Dieoff in Ponds," J. Sanitary Engineering Div., ASCE, 98, SAI 59-69 (Feb. 1972).

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Based on these comments and the design of the proposed Northglenn system (encompassing three aerated lagoons with 14 days detention time and the very large and long-detention time final reservoir), the potential for problems concerning transmission of waterborne diseases due to the influent source should be minimal. Add to this the capability of chlorinating the effluent from the reservoir if the level of indicator organisms, fecal coliform, increases and the system appears to be adequately safeguarded in terms of waterborne disease transmission potential.

CHAPTER III
DESIGN EVALUATION

The major areas to be discussed in this chapter are: (1) the conversion from the conceptual work performed by Dr. McKinney to final design specifications; (2) the energy requirements of the system; and (3) mitigation measures to be considered in case of excessive algal growth in the proposed Bull Canal Reservoir.

CONCEPTUAL TO FINAL DESIGN

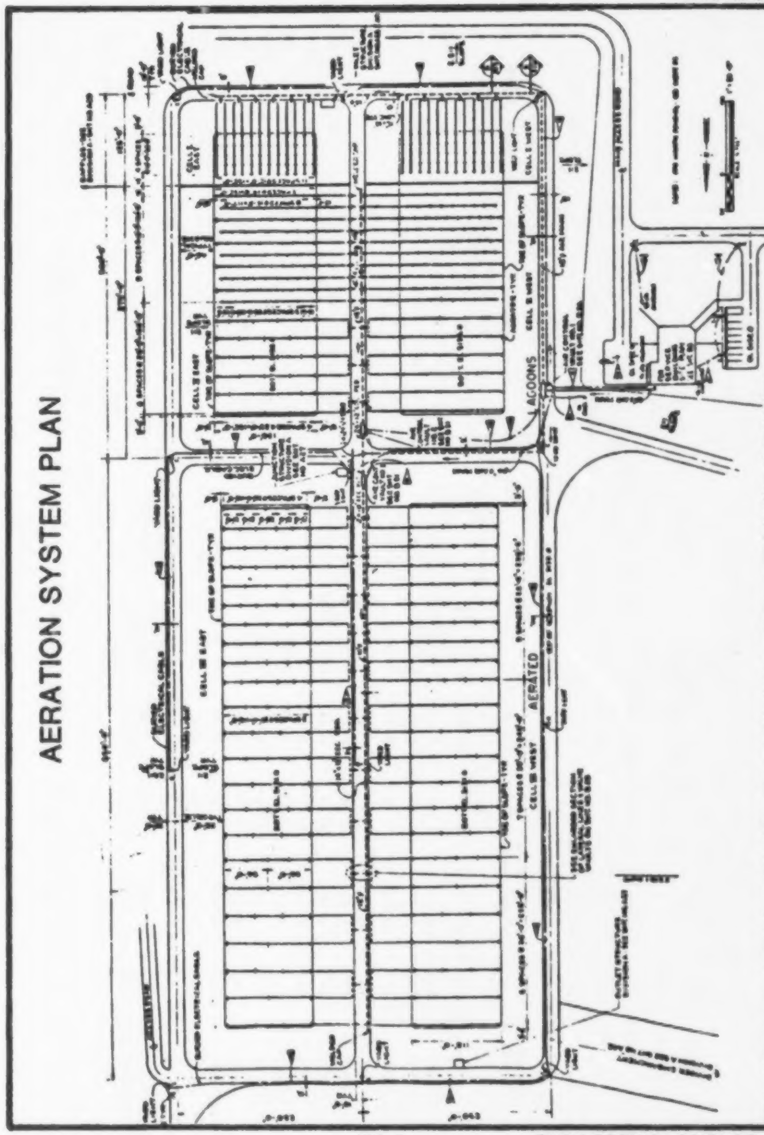
The major questions which have arisen in analyzing the final design for the Northglenn project in comparison to the conceptual design work prepared by Dr. McKinney are in two areas: (1) sufficiency of the aeration system; and (2) analysis of potential temperature losses and thus cold weather treatment capability.

Aeration System

The major points of concern relative to the aerator system are the aerator layout in the first stage and the potential problem with solids resuspension in the third-stage lagoons if the aerators near the effluent point are used extensively.

The design for the first-stage aerated lagoon specifies 64 static aerators at 20 scfm (standard cubic feet per minute) per aerator using 100 horsepower of blower capacity in each 2.3 million gallon cell. These aerators are to be installed as shown in Figure III-1. EPA believes that the number of aerators, their spacing (12 to 13 feet spacing between aerators), and the proposed air flow and blower horsepower are sufficient to supply the required oxygen demand in the first-stage lagoons and if spaced properly 64 aerators should be able to keep the first-stage lagoon completely mixed. There may be a potential problem, however, with keeping the basin completely mixed due to the geometry of the basin. Because so much of the first-stage lagoon volume (approximately 40 percent) lies above the 2:1 interior sideslopes which contain no aerators, the sideslopes may inhibit mixing of solids from the sideslope area, and because the distance from the aerators at the bottom to the

FIGURE III-1


AERATION SYSTEM PLAN

NOTE: Figure prepared from sheet 825 of Sheaffer and Roland, Inc. drawings entitled "City of Northglenn, Colorado Water Management Program Wastewater System, Division 8: Reservoir Site Buildings & Equipment, Aeration System Plan," dated 9/79.

edge of the lagoon is some 40 to 45 feet at the water line (far beyond the zone of complete mix for static aerators), the probability of maintaining the desired complete mix of suspended solids in the first-stage lagoon will not be possible without some type of supplemental aeration system on the sideslopes or some other modifications. Without such modification, the probability of suspended solids settling out in the sideslope areas is considered very high. It should be noted that this would not seriously (if at all) impair overall system efficiences, however, the design specifications as proposed by Sheaffer and Roland, Inc. and Dr. McKinney call specifically for complete mixing of suspended solids at this point which is not possible with the aerator design proposed.

A second area of concern is the location of aerators near the effluent point of the third aerated lagoon cells. If these aerators are needed to supply the required oxygen demand in the third cell, the potential exists that unwanted suspended solids which might otherwise have settled out will remain in the lagoon effluent. If these aerators are used intermittently, high suspended solids in the third stage lagoon effluent may occur whenever the aerators are turned on due to resuspension of previously settled biological solids. It would seem more appropriate to maintain quiescent conditions at the lagoon effluent by eliminating these aerators or by maintaining the same number of third-stage aerators but specifying shorter spacings between aerators in the first one-half to two-thirds of the final cell.

The temperature loss calculations prepared for the aerated lagoon system by Sheaffer and Roland, Inc. are shown in Table III-1. These calculations underestimate the heat loss from mixed aerated lagoons. The calculation procedure shown on the table is for quiescent lagoon systems. This causes major errors in estimating heat loss for aerated-mixed lagoons for two reasons: (1) the mixing action continuously brings warmer subsurface waters to the surface thus allowing additional heat transfer to the atmosphere, and (2) the mixing action prevents the formation of a relatively stable thermal zone at the surface which normally inhibits heat transfer, in quiescent lagoons, to the lower

TABLE III-1

TEMPERATURE LOSS CALCULATIONS FOR THE PROPOSED NORTHGLENN TREATMENT SYSTEM

	Influent Waste-water temp. °C$_a$	Average Air Temp., °C$_b$	Cell I Temp., °C/biol. coeff.$_d$	Cell II Temp., °C/biol. coeff.$_d$	Cell III Temp., °C/biol. coeff.$_d$	Reservoir Temp., °C/biol. coeff.$_d$	Detention Time$_e$				Cell I Influent BOD$_5$,mg/l$_f$
							Cell I hrs.	Cell II hrs.	Cell III hrs.	Reservoir days	
Jan.	12.8	-2.8	10.5/0.51	5.4/0.15	0.3/0.08	0.1/0.07	23.0	92.1	207.3	185	193.0
Feb.	13.7	-0.9	11.5/0.55	6.8/0.40	2.0/0.10	0.1/0.07	22.7	90.9	204.6	156	190.6
Mar.	14.6	2.7	12.8/0.61	9.0/0.46	5.0/0.14	1.9/0.09	22.2	88.8	199.9	126	186.4
Apr.	15.6	8.3	14.6/0.68	12.2/0.58	9.6/0.48	7.4/0.41	20.3	81.2	182.7	96	172.2
May	16.5	13.5	16.1/0.76	15.2/0.72	14.0/0.66	17.6/0.60	13.8	55.0	123.8	67	123.3
June	17.4	18.7	17.4/0.84	17.5/0.84	17.6/0.84	17.7/0.85	13.6	54.4	122.4	46	121.9
July	18.3	22.0	18.5/0.90	19.1/0.94	19.9/0.99	20.9/1.07	13.8	55.0	123.8	32	123.3
Aug.	17.4	21.2	17.7/0.85	18.4/0.90	19.3/0.95	20.1/1.01	17.4	69.7	156.8	20	150.9
Sept.	16.5	16.5	16.4/0.78	16.1/0.76	15.8/0.75	15.5/0.73	18.7	75.0	168.7	14	160.5
Oct.	15.6	10.3	14.8/0.69	12.9/0.61	11.0/0.53	9.4/0.48	21.0	84.1	189.2	249	177.9
Nov.	14.6	2.8	12.8/0.60	8.9/0.46	4.9/0.14	1.9/0.10	22.8	91.3	205.5	242	191.2
Dec.	13.7	-0.6	11.5/0.55	6.8/0.40	2.1/0.10	0.1/0.07	23.2	92.7	208.6	216	194.1

a. based upon an average influent wastewater temperature range of 55°F (12.8°C) in winter and 65°F (18.3°C) in summer

b. based upon local average monthly temperature data

c. based upon the thermal energy balance equation

$$Tw = (10^6 QTi + AKTe)/(AK + 10^6 Q)$$

Where
Tw = water temperature, °C
Ti = influent water temperature, °C
Te = equilibrium water temperature °C (one degree less than average air temp.)
K = surface heat exchange coefficient, cal/d-m^2-°C (a value of 0.7 X 10^6 is typical)
Q = flow rate, m^3/d
A = lagoon surface area, m^2

d. based upon the temperature correction equation

$$c_T = e^{\theta(T-20)}$$

Where
c_T = temperature correction coefficient from a standard 20°C condition
θ = 0.07 for temperatures between 6° and 25°C
0.13 for temperatures between 0° and 6°C
T = actual water temperature

e. based upon projected monthly inflows and a design flow of 4.64 MGD

f. based upon the projected monthly rates of wastewater to stormwater inflows and predicted wastewater + stormwater characteristics; assumes worst case treatment conditions, i.e., no well water flows will be used for make-up water, only wastewater and stormwater

SOURCE: Sheaffer and Roland, Inc., Memo of 11/16/79 to Bob McGregor from Lee Rozaklis, Subject: NPDES permit for Bull Canal Reservoir.

levels by maintaining a low differential temperature at the air/water interface to impede convective heat transfer (i.e., the upper water layer acts as an insulator for the lower layers).

Thus, the estimates of BOD$_5$ removals and nitrification which have already been questioned may be even more seriously impacted due to lower than anticipated water temperatures in the aerated lagoons and reservoir. As an example, by assuming that the surface heat exchange coefficient (k) is double that used by Sheaffer and Roland, Inc. in their calculatios (this assumption is believed to be a conservative assumption in terms of comparison to what the actual k values are for statically aerated lagoons), the January lagoon temperatures calculated would be 8.5 degrees C in cell number 1 (compared to 10.5 degrees C), 1.9-degrees C in cell number 2 (compared to 5.4 degrees C), and -2.2 degrees C in cell number 3 (compared to 0.3 degrees C). At these low temperatures, nitrification and BOD$_5$ removal would be almost nonexistent in the second and third cells.

ENERGY REQUIREMENTS

To ascertain the energy efficiency of the proposed Northglenn treatment system, the power requirements (kWh per year) for the installed aeration horsepower for the Northglenn site have been compared to the total estimated power requirements for four other systems designed to provide equivalent or similar treatment levels to those stated for the Northglenn aerated lagoons. The estimated power requirements for these systems are based on information presented in "Water Quality Management Planning Methodology for Municipal Waste Treatment Needs Assessment," prepared by Engineering-Science, Inc in March of 1977 for the Texas Department of Water Resources for use in estimating point-source controls, costs, and requirements in non-designated 208 planning areas. The Northglenn power requirements including estimated conveyance and other miscellaneous power requirements also are compared to the estimated power requirements, including conveyance requirements, for Denver Metro to treat the Northglenn wastewaters.

The first system utilized for comparison is an extended aeration (activated sludge) system preceded by primary treatment including primary clarification and followed by final clarification with recycle. The effluent quality from the system used would be expected to meet effluent limitations of 20 mg/l BOD$_5$, and 3 mg/l ammonia-nitrogen on a monthly average basis. The design of the aeration basin is determined by nitrification requirements. The annual energy requirements for such a system are estimated to be 4.8×10^6 kWh.

The second system used for comparison is a conventional activated sludge plant with primary treatment, including primary clarifiers, and using final clarification and sludge recycle. The effluent from a system such as this design represents would be expected to meet a permit requirement of 20 mg/l BOD$_5$ as a monthly average. Little or no nitrification would be expected from such a system. The annual energy requirements for such a system are estimated at 2.25×10^6 kWh per year.

The third system investigated consists of primary treatment, including primary clarifiers, rotary biological contactors designed based on BOD$_5$ removal requirements, and final clarification. Such a system would be expected to meet effluent limitations of 20 mg/l BOD$_5$ and 10 mg/l ammonia-nitrogen as monthly averages. The estimated annual energy requirements for such a system are 0.72×10^6 kWh.

The final system used for comparative purposes is similar to the third system except that the rotary biological contactor area is determined based on nitrification requirements. The system would be expected to meet a 15 mg/l BOD$_5$ and 2 mg/l ammonia-nitrogen permit limitation on a monthly average basis. The estimated annual energy requirements are 2.03×10^6 kWh.

In each of the above cases, the system design in terms of BOD$_5$ removal is determined based on an average flow rate of 4.6 million gallons per day, an influent BOD$_5$ concentration of 200 mg/l, an influent TSS concentration of 190 mg/l, and an influent ammonia concentration of 35 mg/l. The sizes of the primary and secondary clarifiers and thus the associated energy requirements are based on a peak flow rate of 13.1

million gallons per day. Stated effluent quality would be expected to be met even with daily peak rates of 13.1 million gallons per day as specified by Northglenn. Such hydraulic peaks have very little effect on energy requirements based on oxygen requirements because these peak flows normally have low BOD_5 concentrations. Thus, the overall effect of these high flows on energy requirements is quite small. Each system design includes solids handling energy requirements consisting of gravity thickening and anaerobic digestion. The energy associated with final disposal is assumed to be equal for all systems.

The estimted energy requirements for Denver Metro to accept and treat the City of Northglenn wastewaters was estimated from Denver Metro's 1980 budget. The budget listed energy use as 59.32×10^6 kWh per year for primary and secondary treatment, sludge handling, and effluent chlorination for a flow of 123 million gallons per day. Based on these values, the energy requirements by Denver Metro are 482,276 kWh per year per million gallons treated per day. Thus, the energy requirements which would accrue to the City of Northglenn's wastewaters for treatment by Denver Metro may be estimated as 2.23×10^6 kWh per year exclusive of conveyance costs. The estimated energy requirements for conveyance to Denver Metro are 1.01×10^6 kWh per year based on an average flow rate of 4.62 million gallons per day through the Henderson and North Washington pump stations. Thus, the total estimated energy requirements for treatment by Denver Metro is 3.24×10^6 kWh per year. In order to estimate the energy requirements for equivalent treatment (including nitrification) at Denver Metro, an additonal energy requirement of 0.9×10^6 kWh per year was estimated based on information contained in "Energy Conservation in Municipal Wastewater Treatment," an EPA publication. Thus, the total energy requirements for treatment of City of Northglenn wastewaters to an effluent quality comparable to that estimated for the proposed Northglenn system is approximately 4.21×10^6 kWh per year.

The required operating aeration blower horsepower for the Northglenn project with all static aerators operating at 20 scfm is 880 horsepower. This value is specified on page IV-18 of the Basis of Design memorandum of September 27, 1979, prepared by Sheaffer and Roland, Inc. This represents installed power levels of 200 horsepower for the first aerated lagoon cells (100 horsepower each), 400 horsepower for the second cells (200 horsepower each), and 280 horsepower for the third cells (140 horsepower each). Based on these required horsepower levels, the annual energy requirements for aeration of the aerated lagoons would be 5.76×10^6 kWh. The proposed system calls for the installation of six 2,650 cfm (300 horsepower) blower units with one to be used as a spare. These would be capable of supplying all of the proposed aerators with 40 cfm or double the design value of 20 cfm. Thus, if the 40 cfm should be required, the annual energy requirements would be 9.8×10^6 kWh for the aeration system blowers alone. The most energy efficient case which can be estimated would require the entire 200 horsepower for the first-stage aerated lagoons (to obtain the maxmum mixing level attainable) and at least 70 percent of the required 400 horsepower for the second stage (280 horsepower). Thus, if the third lagoon could be left completely unaerated, the annual energy requirements would be in excess of 3×10^6 kWh for aeration only. Due to the deep basin design, it is doubtful that the third cell lagoons could be maintained without odors if left completely unaerated. Thus, it appears that for aeration the proposed Northglenn system would require a minimum of approxmately 3×10^6 kWh per year to a maximum of 9.8×10^6 kWh per year.

The estimated energy requirements for conveyance for the proposed Northglenn system based on flows and information supplied by Sheaffer an Roland, Inc. is 0.758×10^6 kWh per year. To the previous energy requirements for Northglenn, a conservatively estimated 0.36×10^6 kWh per year should be added to account for sludge handling and disposal, Bull Canal Reservoir discharge pumping, chlorination, and other miscellaneous energy requirements.

The estimated energy requirements for the four alternate systems shown as well as for Metro Denver treatment and for the proposed Northglenn system are summarized in Table III-2. The alternate system designs are not developed to the same degree of accuracy as the proposed Northglenn system.

TABLE III-2

COMPARISON OF ANNUAL ENERGY REQUIREMENTS FOR PROPOSED NORTHGLENN TREATMENT SYSTEM AND SELECTED ALTERNATES

Treatment	Annual Energy Requirements at Full Horsepower Usage (KWH/yr)	Design Effluent	
		BOD_5	NH_3
Proposed Northglenn System			
Lagoon system only Conveyance & miscellaneous Total	5.76×10^6 1.12×10^6 6.88×10^6	-	-
Metro Denver			
Without conveyance With conveyance Total	3.13×10^6 1.01×10^6 4.14×10^6	-	-
Primary clarifier - extended aeration (designed for nitrification) - final clarifier	4.8×10^6	<20	<3
Primary clarifier - activated sludge - final clarification	2.25×10^6	<20	No nitrogen assumed
Primary clarifier - RBC (designed based on BOD_5 removal requirement only) - final clarifier	0.72×10^6	<20	<10
Primary clarifier - RBC (designed for nitrification) - final clarifier	2.03×10^6	<15	<2

PROPOSED MITIGATION MEASURES

The mitigation measures for meeting effluent limitations with respect to algae control and/or removal, should this become necessary for the effluent from the Bull Canal Reservoir, were analyzed by Sheaffer and Roland, Inc. in a letter to Mr. R.P. Lundahl of the City of Northglenn dated February 25, 1980. The mitigation measures encompassed in that letter are: (1) use of algicide, (2) use of flocculants, (3) use of biological controls (algae-consuming fish, primarily tilapia), (4) selective discharge, and (5) filtration. Of these proposed mitigation measures, the following comments can be made:

(1) The use of algicide or flocculants to control algae growth in the reservoir is a stop gap method and does not eliminate the root cause of such growth, that is excessive supplies of nutrients and carbon for algal growth. Thus, it may be effective on a spot basis or for a period of time, but it does not represent a long-term solution to algae growth except through repeated applications.

(2) The use of repeated applications of algicides such as the $CuSO_4$ proposed at Northglenn could lead to unacceptable buildup of copper concentrations in the reservoir sediments and impact crops irrigated with the water.

(3) The use of biological controls such as tilapia fish should be relatively acceptable. It should be noted, however, that no assurances can be made that such controls would be able to maintain permit compliance. The use of biological controls presupposes that the control species will not exhibit selectivity for habitat in the reservoir or for specific types of algae. Situations could develop where large growths of alge of a type not desired by the biological control species could be formed and jeopardize permit compliance even while large numbers of the control species were working to reduce the more preferred algal types to very low levels. Additional problems which may occur due to the use of biological controls include

the necessity to annually restock the control organism (especially tilapia) due to seasonal losses, the necessity for modifications to the Bull Canal discharge facilities to prevent release of the organisms into Bull Canal and associated waterways, and the necessity of disposing of large quantities of harvested or winter-killed organisms.

(4) The use of selective discharge at various depths within the reservoir could be viable in terms of reducing the effect of algae from surface blooms near the effluent structure affecting effluent quality. As the sole method of mitigating large quantities of algal growth, however, this control measure does not appear sufficiently effective.

(5) The use of filtration for algae removal has been documented as being too expensive, not particularly effective, and prone to severe operational difficulties for large systems. Thus, this should be the last method considered for algal-related TSS removal.

CHAPTER IV
CONCLUSIONS

The conclusions presented in this chapter are based on the results of the analyses and study of the materials supplied by Sheaffer and Roland, Inc. describing the treatment concepts and design for tHe proposed Northglenn wastewater treatment system.

(1) The collection period fcr data describing the raw waste load to the proposed system spanned a 13-day period in February and March of 1978. The data collected were for the existing Northglenn wastewaters only and did not include analyses of the other sources, such as irrigation return flow and storm water runoff, which also will be treated. This data base does not represent a sufficient sampling and analytical effort for the proposed Northglenn wastewater treatment system. There is no assurance that the two-week period represents year round wastewater characteristics especially the very important ammonia-nitrogen:alkalinity ratio. The ammonia-nitrogen concentrations from the sampling were abnormal for municipal wastewaters and should have been investigated further, and the quality of the additional sources of wastewater and the new potable water source (Standley Lake) should have been characterized and taken into account in determining design wastewater quality.

(2) The pilot-plant studies of aerated lagoon treatment using the detention times and three-series-cell concept proposed for Northglenn were professionally performed and the results were typical of the treatment expected for long-detention-time aerated lagoons. Three problems exist, however, in applying the results of these studies directly to the proposed Northglenn wastewater treatment system:

(a) Lawrence, Kansas, wastewaters, not a composite representing the actual wastewater to be treated (City of Northglenn, irrigation return flow, and storm water runoff), or City of Northglenn wastewaters, were used for the tests and differences in ammonia and alkalinity relationships between the wastewaters as well as other differences do not appear to have been adequately evaluated.

(b) There was insufficient run time under cold-weather operating conditions for the pilot facility to exhibit the response of such systems to the low temperatures which may be expected to occur in the full-scale facility..

(c) The effect of the proposed Bull Canal Reservoir on effluent quality from the proposed system was not effectively considered in the pilot studies.

(3) The proposed Northglenn wastewater treatment system should under most conditions have no trouble meeting the proposed BOD_5 limits for the Bull Canal Reservoir effluent. Two situations could occur which could cause the permit BOD_5 levels to be exceeded:

(a) During summer or warm-weather operation, there exists a potential for high algal levels in the effluent from the reservoir. If the algae levels are high enough, the attendent BOD_5 contribution could cause permit limits to be exceeded.

(b) During winter operation, the treatment efficiency of the three-stage aerated lagoon will be significantly reduced. If the effluent BOD_5 from the aerated lagoons reaches a high enough level for a long enough period of time, the effluent from the reservoir could be affected and the effluent BOD_5 could exceed permit requirements. The possibility for high flow rates due to storm water runoff during winter operation, which would decrease average treatment time in the aerated lagoons and further decrease BOD_5 removal efficiency due to cold weather, further increases the risk of the effluent BOD_5 exceeding permit limits during winter operation.

(4) The probability that the proposed system will continuously meet effluent TSS requirements (30 mg/l monthly average and 45 mg/l 7-day average) is believed to be rather low. The probability of exceeding the permit requirements in the summer due to levels of algae growth in Bull Canal Reservoir is high. Another factor which could contribute to high effluent TSS during the summer is the potential for high influent flow rates carrying large sediment loads during periods of minimum reservoir volume. During winter operation, the effluent TSS should, however, pose no problem.

(5) A key operational feature of the proposed three-stage lagoon system is the achievement of essentially complete nitrification and the attendent removal of alkalinity in the second and third-stage aerated lagoons. This capability is necessary to achieve the carbon limiting system which is designed to limit algal growth in the final reservoir. Due to the very low temperatures expected in the second and third lagoon stages during cold-weather operation (below 7 and 2 degrees C for three months in cells 2 and 3, respectively) adequate nitrification to achieve this goal will not be possible. A second contributing factor to low nitrification levels in the winter will be increased BOD$_5$ loadings on the second and third lagoon cells due to cold-weathr reductions in BOD$_5$ removal efficiencies. This increase in carbonaceous demand will further inhibit nitrification due to the reduced capability of the nitrifying organisms to compete.

(6) The capability of the proposed Northglenn system to maintain carbon limiting conditions to inhibit algal growth in the Bull Canal Reservoir and thus attain effluent TSS requirements is dependent on a complex series of reactions and interactions. No controls of phosphorus or nitrogen are proposed and it is recognized that sufficient amounts of these nutrients will be available to support large algal growths. The ability of the proposed system to achieve the desired carbon limiting conditions is dependent upon many factors. The following are believed to be the most important of these factors:

(a) essentially complete nitrification in the aerated lagoons with attendent alkalinity removal;

(b) 30 to 35 mg/l of ammonia-nitrogen in the raw waste on a continuous basis;

(c) essentially complete removal of carbonaceous BOD$_5$ in the aerated lagoons; and

(d) exceptionally low, for aerated lagoons, effluent TSS from the lagoons to the reservoir.

The high potential for BOD$_5$ losses in the 30 to 50 mg/l concentrations, the high potential for low or no nitrification rates and thus high alkalinity during winter operation, the carryover of organics-containing TSS from the lagoons to the reservoir, and the direct transfer of carbon dioxide from the atmosphere to the reservoir combined to make it unlikely that a carbon limiting system can be maintained in the reservoir.

(7) The proposed Northglenn system should exhibit excellent removals of fecal coliforms due to both the long detenton times through the aerated lagoons and Bull Canal Reservoir and the capability of chlorinating the reservoir's effluent. The State of Colorado has proposed effluent fecal coliform requirements of 1,000/2,000 colonies per 100 ml for th 30-day and 7-day averages for the reservoir effluent. Only extreme circumstances such as severe short-circuiting in the reservoir or complete loss of biomass in the aerated lagoons could produce excessive effluent levels under these requirements. For the 1,000/2,000 limits, the necessity for chlorination, proposed for as-required operation, should be minimal. EPA will require stricter limits of 200/400 colonies per 100 ml. These limits could very well require chlorination of the reservoir effluent for considerable periods of time and possible at all times.

(8) The design of the proposed Northglenn system which utilizes three aerated lagoons in series with a long detention time in the final reservoir should result in a very low potential for

problems concerning the transmission of waterborne diseases due to the influent wastewaters. Add to this the capability of chlorinating the effluent from the reservoir if the fecal coliform level increases and the system appears to be adequately safeguarded in terms of waterborne disease transmission potential.

(9) The design of the aeration system for the first aerated lagoon cells will not be capable of maintaining complete suspension of suspended solids. This is due primarily to the geometry of the cells and the effective zone of complete mixing for static aerators. Thus, some settling of suspended solids on the sidewalls of the first-stage lagoons can be expected. This is not expected to seriously impair system efficiencies. It does, however, represent a departure from the system specifications as set forth by Sheaffer and Roland, Inc. and Dr. McKinney.

(10) The location of static aerator tubes near the effluent structures in the third-stage lagoons may cause problems in terms of effluent TSS concentration from the third lagoons. These aerators, when in use, may keep suspended solids which might otherwise have settled out from settling. The intermittent use of these aerators could lead to short-term high TSS concentrations in the lagoon effluent due to resuspension of previously settled solids in the areas around these aerators.

(11) The temperature calculations for cold-weather operation made by Sheaffer and Roland, Inc. utilize an equation designed for quiescent lagoons. The temperatures thus calculated for winter conditions are too high for the statically aerated and mixed lagoon system proposed for Northglenn. The negative effects of cold weather on BOD_5 removal and nitrification during winter operation cited previously may thus be further magnified.

(12) The aeration energy requirements for the proposed Northglenn wastewater treatment system were compared to the estimated total energy requirements for treatment using extended aeration, activated sludge, and rotary biological contactors. The Northglenn aeration energy requirements are from 20 to 800 percent greater than the estimated energy requiremetns for these other systems.

(13) The total estimated energy requirements for the proposed Northglenn wastewater treatment system, including aeration and conveyance energy and other miscellaneous requirements, were compared to the estimated energy for conveyance to and treatment by Denver Metro. The results of this comparison indicate that the proposed Northglenn wastewater treatment system will require approximately 60 percent more energy than treatment by Denver Metro.

(14) Several measures for algae control within the Bull Canal Reservoir, should this become necessary, have been analyzed. These measures included: (a) use of algicides, (b) use of flocculants, (c) use of biological controls (algae-consuming fish, primarily tilapia), (d) selective discharge, and (e) filtration. Biological controls and selective discharge are potential measures for the reduction in algal and suspended solids in the reservoir effluent. Selective discharge is a design feature of the proposed effluent facilities and provides operational flexibility for suspended solids control. If it is necessary to implement additional suspended solids controls, and if Northglenn selects biological organisms as the control strategy (non-native species such as tilapia), it will be necessary to ensure total containment of the species. This containment is desirable to prevent introduction into State waters and prevent competition with native, game species. Containment will require proper-sized screening of outlet structures and/or continuous chlorination.

APPENDIX F

ALTERNATIVE TREATMENT SITE ANALYSIS

APPENDIX F

ALTERNATIVE SITE ANALYSIS

INTRODUCTION

The Northglenn water resource management plan initially considered nine alternative sites for wastewater treatment and storage. At that time, the treatment and reservoir system were perceived as being larger than currently planned, because the project was being sized to provide treatment and storage for wastewater from both Northglenn and Thornton. In addition, the reservoir was to be located on a natural drainage thus reducing reservoir construction requirements and costs. Thus, larger land requirements were necessary. However, Thornton has withdrawn from participating in the project, and other changes have been made which effectively reduce land and other site requirements.

Seven criteria were used by Northglenn to evaluate the alternative sites. These criteria included:

- compability with surrounding land use
- safety of reservoir design
- control of seepage losses
- underlying mineral resources
- operational flexibility
- consistency with approved wastewater management plans
- severability of system components

The complete analysis of each site is presented in Northglenn's Application for Site Approval (Reference 21). However, the site analysis presents a bias toward the selected site, Site 10, because sites one through nine were evaluated for both a larger and physically different treatment and storage facility as originally proposed. Site ten was the only site evaluated for the revised treatment and storage facility.

In view of the above, EPA determined it was necessary to conduct an alternative site analysis for a wastewater treatment and storage system identical to the currently proposed Northglenn facility. EPA recognizes the fact that Northglenn has expended a considerable amount of time and money investigating and designing for Site 10. However, it has not been demonstrated that the selected treatment and storage site is environmentally suited for the currently proposed facility. Therefore, this alternative site analysis evaluates three additional sites for treatment and storage of Northglenn's wastewater.

The purpose of this analysis is to determine if another site is more environmentally acceptable, and whether Northglenn's proposed treatment site is environmentally acceptable when compared to other sites.

This analysis will not develop information to the level of detail currently available on the proposed site, since that level is specific for design consideration. This analysis considered all four sites (including Site 10) from an initial screen perspective, using existing data. The selection criteria for the three additional sites were:

- site would require no more than three residences to be relocated
- the site is not located in a natural drainage

Based on these criteria the three sites located on Figure F-1 and designated as A, B, and C were selected.

All four sites are evaluated using the following environmental criteria:

- geology
- groundwater
- soils and construction geology
- topography and flooding
- land use
- proximity to the Bull Canal
- consistency with land use plans

Additionally, the cost of relocating the proposed facility to one of the new sites was considered.

A summary of the environmental analysis of alternative sites is presented in Table F-1.

GEOLOGY

Mineral Resources

Potential mineral resources in the alternative site study area include sand, gravel and quarry aggregates, coal, oil, and natural gas.

Sand, gravel and quarry aggregates are the raw materials used in the construction of buildings, roads, and virtually all other man-made structures. Industrial, commercial or residential development over recoverable deposits of these resources essentially precludes any future use. To avoid loss of the use of these resources, surface development should be sited away from recoverable deposits. No recoverable sand, gravel or quarry aggregates occur on any of the alternative facility sites (8).

FIGURE F-1

ALTERNATIVE SITE STUDY AREA

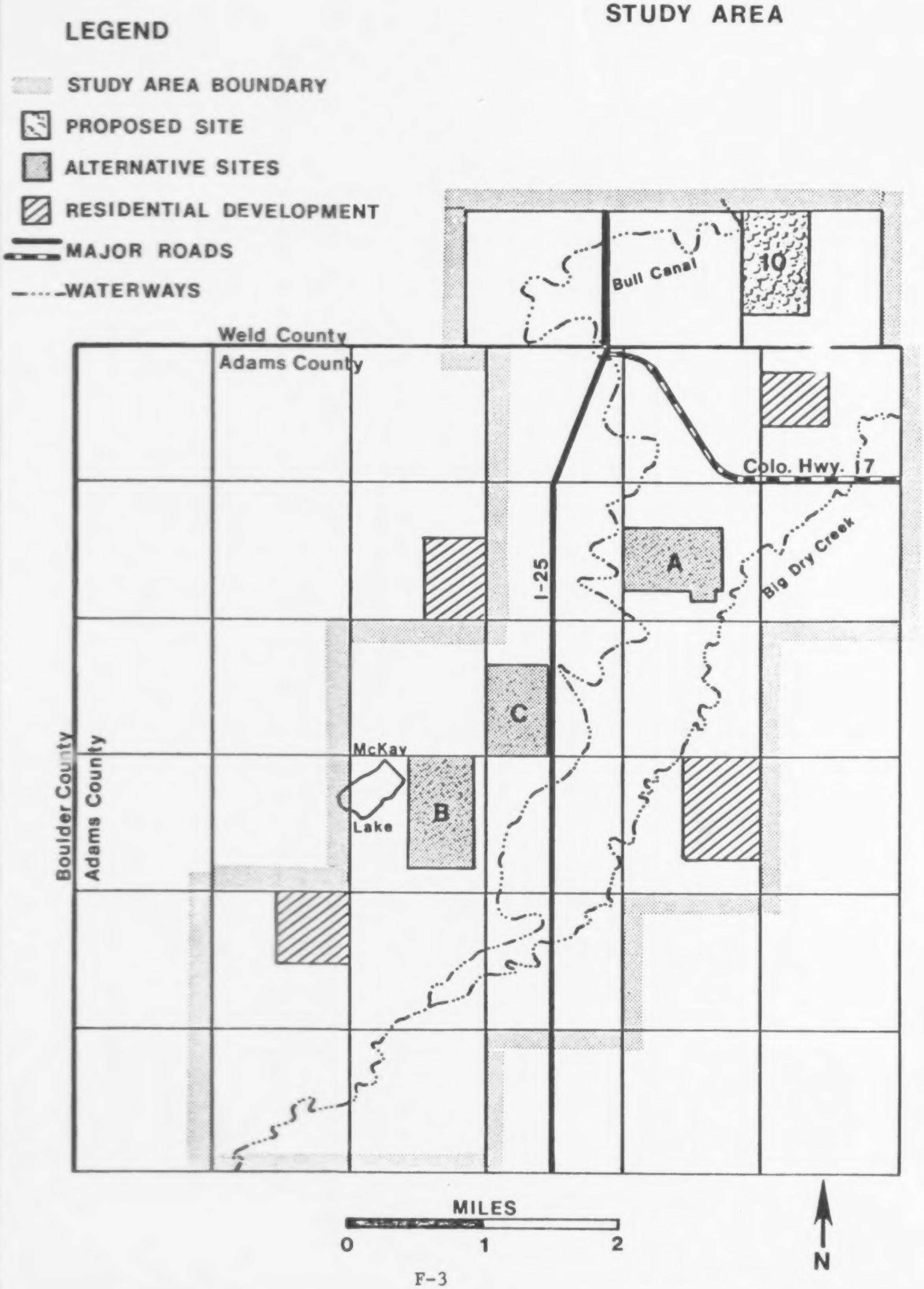

LEGEND
STUDY AREA BOUNDARY
PROPOSED SITE
ALTERNATIVE SITES
RESIDENTIAL DEVELOPMENT
MAJOR ROADS
WATERWAYS
10
Bull Canal
Weld County
Adams County
Colo. Hwy. 17
A
I-25
Big Dry Creek
C
McKay
Lake
B
Boulder County
Adams County
MILES
0
1
2
N

TABLE F-1 ENVIRONMENTAL EVALUATION MATRIX OF ALTERNATIVE TREATMENT AND STORAGE SITES

CRITERION	SITE A	SITE B	SITE C	SITE 10
Geology				
Mineral Resources	No sand or gravel resources, possible oil, gas or coal	No sand or gravel resources, possible oil, gas or coal	No sand or gravel resources, possible oil gas or coal	No sand, gravel or recoverable coal resources, possible oil or gas.
Faults	No active or potentially active faults	No active or potentially active faults	No active or potentially active faults	No active or potentially active faults
Subsidence	Probably not of concern: South of Boulder - Weld Coal Field	Probably not of concern South of Boulder - Weld Coal Field	Probably not of concern: South of Boulder - Weld Coal Field	Probably not of concern: South of Boulder - Weld Coal Field
Soils				
Permeability	Low perm., 0.06 - 20 in/hr	Low perm., 0.06- 20 in/hr	Low perm., 0.06 - 20 in/hr	Low perm., 0.06 - 20 in/hr
Suitability for Construction	Med. to low shear strength Mod. to high shrink-swell pot.	Med. to low shear strength Mod. to high shrink-swell pot.	Med. to low shear strength Mod. to severe shrink-swell pot.	Low shear strength, Mod. shrink-swell pot.
Prime Agriculture Land	Yes - if irrigated	Yes - if irrigated	Yes - if irrigated	Yes - if irrigated
Topography				
Slope	East half 3-5% slope to east West half 0-3% slope to east Total elevation change 60 ft.	0-3% slope toward southeast Total elevation change 50 ft.	3-9% slope around two knolls rear center of site; total elevation change 55 ft.	3-5% slope around knoll in southeast corner; 0-3% slope to northwest corner, total elevation change 60 ft.
Flooding Potential	Slight	Moderate	Moderate	Slight
Groundwater				
Depth	Perched: 6-12 ft, Deep: 70 - 300 ft.	Perched: 8-15 ft. Deep: 25 - 120 ft.	Perched: 8-12 ft. Deep: 25 - 70 ft.	Perched: 6-10 ft. Deep: 28 - 30 ft.
Number of Wells Onsite	2(1 municipal, 1 other uses)	2(1 domestic, 1 irrigation and stock)	0	0
Land Use				
Current	Agriculture	Agriculture	Agriculture	Agriculture
Zoning	A-3	A-3	A-3	Agricultural
No. of Residences	None on site; 20-30 within 1/2 mile	None on site; 40 - 80 within 1/2 mile	None on site; 30 - 40 within 1/2 mile	None on site; 20 - 30 within 1/2 mile
Proximity to Bull Canal	200 ft.	900 ft.	300 ft.	50 ft.
Cost 1/	$30,247,900	$30,326,600	$30,110,400	$30,242,300

1/ Does not include costs of delaying project.

Coal has been mined in the Denver Basin, which includes the alternative site study area, since 1863. In the past century over 100 million tons of coal have been produced from the Boulder-Weld Coal Field in southeastern Boulder County and southwestern Weld County. The alternate site study area is partially included in this coal field (Figure F-2), and parts of sites 10 and B are within the approximate boundary of areas known to be underlain by beds of Laramie Coal that are five feet thick or greater (Figure F-3). Sites A and C are within a mile of known Laramie beds (10). Test holes drilled on and around Site 10 encountered two seams of coal, neither more than 2.5 feet thick. The seams were from 450 to 600 feet below the land surface (12). The coal seams are considered both too thin (12) and too far below the surface (7) to be economically recoverable. Coal workings generally do not go below 500 feet because of economic and engineering considerations (7). Coal seams probably lie under Sites A, B, and C but test holes would have to be drilled to determine the thickness and depth of the seams. Coal beds in the area are thought to be at a depth of 500 to 1,000 feet (10).

The alternative sites are within the Spindle oil and Wattenburg gas fields (12). None of the sites currently has any producing oil or gas wells, but active wells exist within a mile of any of the alternative sites. While oil and gas reserves may exist beneath the alternative sites, the technology exists to develop such resources after the facility has been constructed (12).

Faults

Faults are fractures in the underlying rock along which movement of rock blocks has occurred due to stress and motion in the earth's crust. An active fault is one which has shown displacement within the last two million years. A potentially active fault has shown displacement within the last 25 million years (23). A lagoon or reservoir sited in the immediate vicinity of an active fault could be ruptured if activity along the fault resulted in surface displacement. An earthquake resulting from movement along a fault close to the facility could cause damage to the lagoon or reservoir embankments. No active or potentially active faults are known to occur directly under any of the alternative sites. Extensive faulting has occurred west of the alternative facility sites in the foothill area of the Front Range, and faulting associated with the Boulder-Weld Coal Field exists to the north. Neither group of faults appears to extend into the study area (5,6). The Rocky Mountain Arsenal Fault which showed induced activity but no surface displacement in the 1960's is from four to seven miles south of the alternative sites and does not extend under any of the sites (7).

Inactive faults have not shown activity for long periods of time. However, land use activity and development, or man-induced seismicity, might affect their stability (23). In addition, inactive faults could serve as conduits to channel seepage from the lagoon or reservoir into the bedrock aquifers and pollute groundwater. Such seepage could also activate a fault by lubricating fault surfaces as happened at the nearby Rocky Mountain Arsenal Fault. An inactive fault has been found in the northeast corner of Site 10. On-site studies would have to be conducted to determine if inactive faults exist beneath the other three sites.

Figure F-2

BOULDER-WELD COAL FIELD

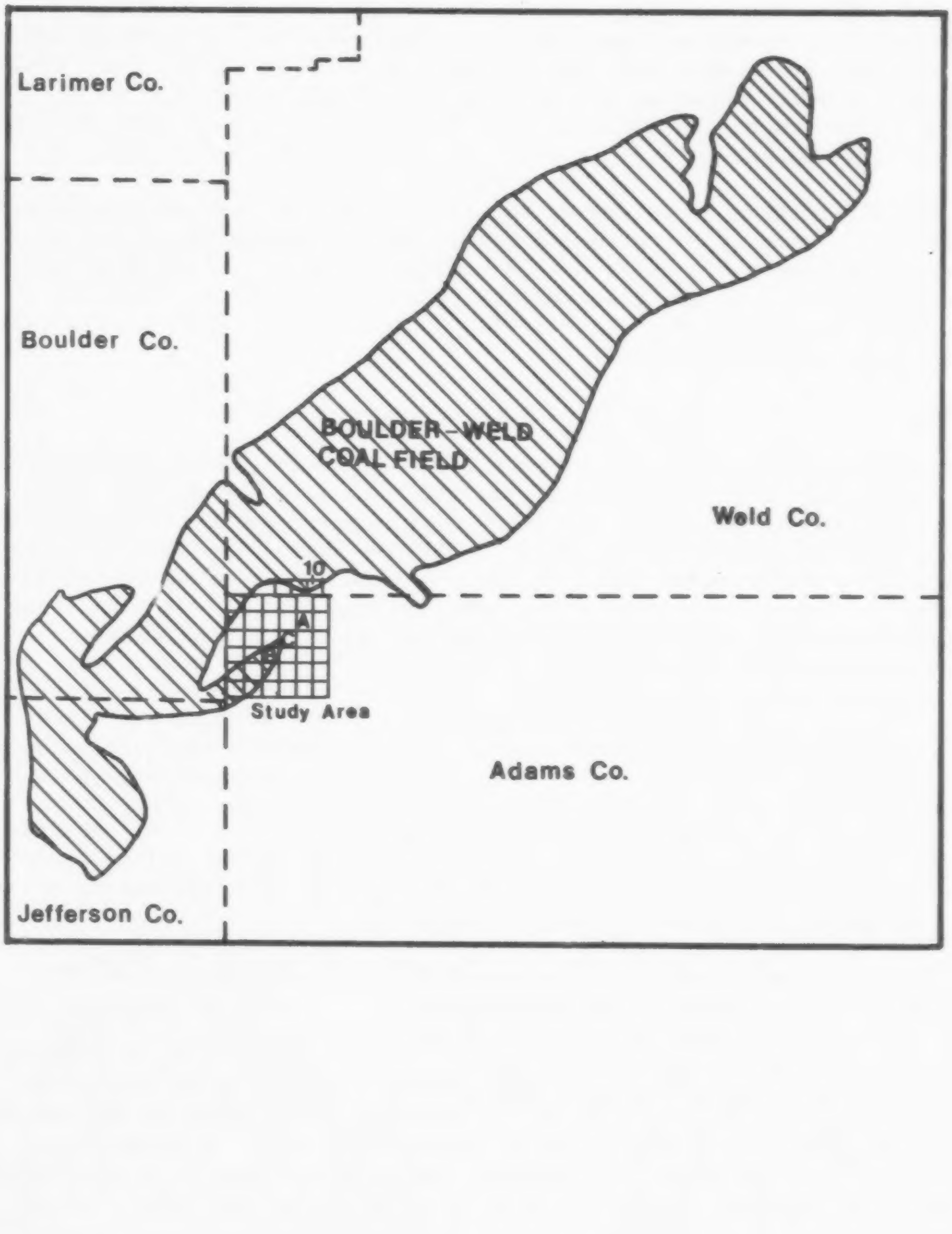
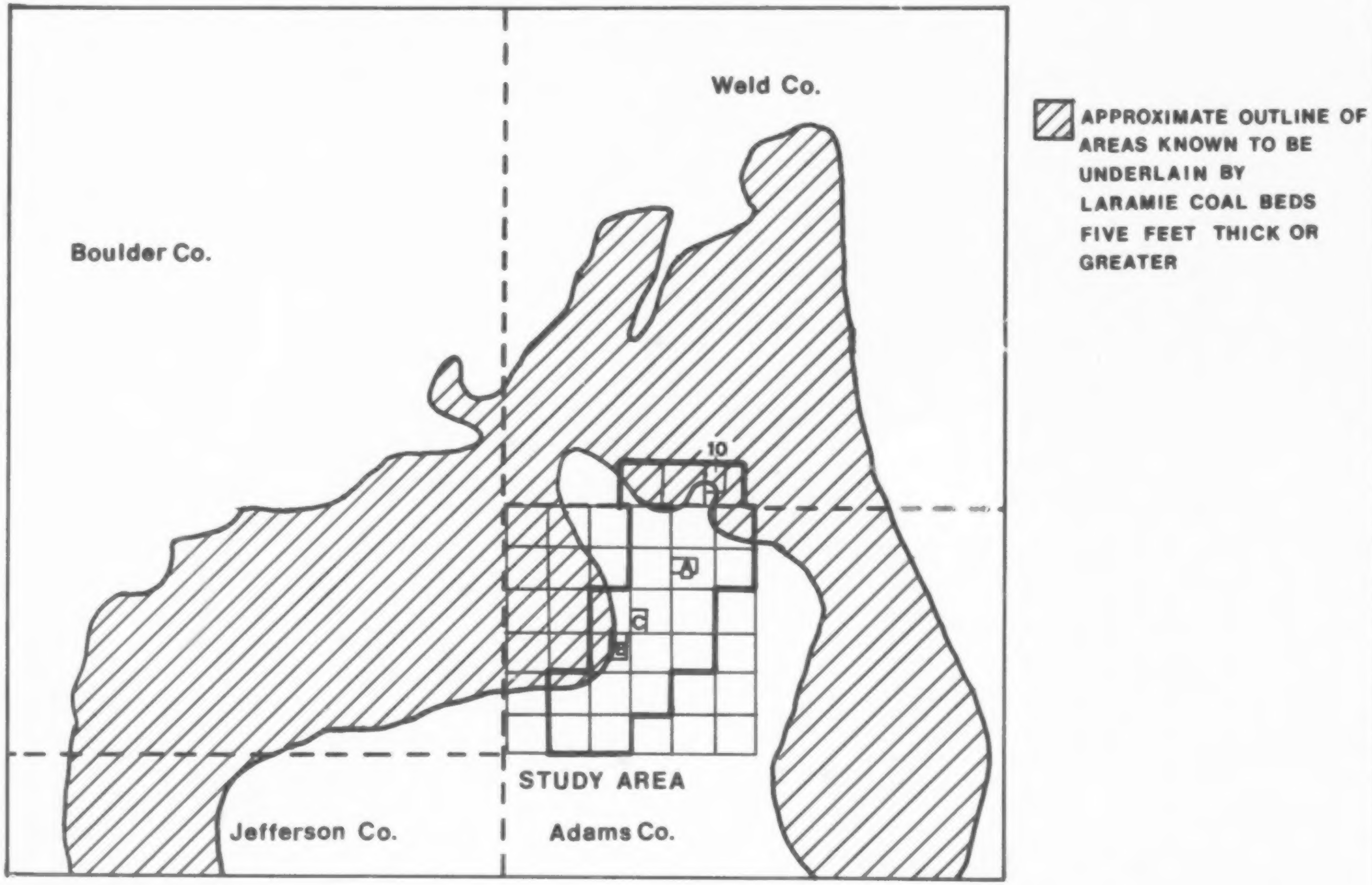

Larimer Co.
Boulder Co.
BOULDER-WELD
COAL FIELD
Weld Co.
10
A
C
B
Study Area
Adams Co.
Jefferson Co.

Figure F-3


Weld Co.
Boulder Co.
10
A
C
B
STUDY AREA
Jefferson Co.
Adams Co.
▨ APPROXIMATE OUTLINE OF AREAS KNOWN TO BE UNDERLAIN BY LARAMIE COAL BEDS FIVE FEET THICK OR GREATER

COAL RESOURCES OF THE STUDY AREA

Subsidence

The Boulder-Weld Coal Field in southeastern Boulder and southwestern Weld Counties (Figure F-2) was extensively mined in the latter portion of the last century and the first half of this century. Many areas within the coal field have subsided as a result of mining activity. However, all four alternative sites lie in areas where the coal is too deep to have been economically mined (7,10). Virtually no coal mining has occurred in or around the alternative site study area; therefore, none of the sites is expected to be affected by subsidence (6).

GROUNDWATER

The depth and fluctuations of the groundwater below each alternative site is important in order to assess the potential impact of lagoon seepage upon beneficial uses. Both the upper groundwater, or perched aquifer, and deeper aquifers are analyzed. Perched aquifers, in agricultural areas, are generally formed by irrigation return water, seepage from irrigation ditches, and alluvial aquifers (alluvial aquifers are those areas which contain groundwater that is hydraulically connected to surface water). Because of poor quality and low yields, perched aquifers are not used extensively as a water supply source. Deeper aquifers are commonly used extensively for domestic, livestock, and irrigation purposes, and thus potential impact to them is of greater concern. Seepage from the lagoons could find its way into these aquifers through faults or cracks in the bedrock beneath the lagoon and reservoir.

All four potential sites are directly underlain by the Arapahoe Formation which has been exposed in a broad east-west band that includes the study sites (11). The Arapahoe Formation is a highly permeable aquifer which generally contains high quality groundwater (10). The aquifer becomes deeper below the land surface as it dips south, and it is an important source of water for Denver's northern suburbs (15). The entire exposed band of Arapahoe Formation, and especially in the Big Dry Creek Area, could be considered as a recharge zone for the aquifer (13, 14).

Well logs from the U.S. Water and Power Resource Service (formerly the Bureau of Reclamation) indicate the groundwater level in the Arapahoe aquifer around the alternative site study area is 10 to 30 feet below the surface (14). The depth to groundwater in this formation beneath Site 10 varies from 11 to 38 feet (13). A perched water table near the Bull Canal was identified to be about seven feet deep and is believed to be a result of seepage from the canal. The depth to water beneath the other three sites is estimated from well logs of wells drilled near or on the sites (3,9). It appears that the deep aquifer (based on the well logs) beneath Site A is deeper than beneath the other sites which would be an advantage in siting the proposed facilities. However, Site A is immediately adjacent to Big Dry Creek, so that seepage from the lagoons could enter the Big Dry Creek Alluvial aquifer. This aquifer is used as a local water source (3).

Without more detailed information from test drillings beneath Sites A, B and C, it is impossible to determine what differences exist in groundwater beneath the sites. Site A is the most critically located, because of its proximity to the Dry Creek Alluvium. However, mitigation measures to ensure that no groundwater degradation occurs will be necessary at all the sites. These measures can parallel those proposed for Site 10 (i.e., lining the lagoon bottom with clay, the lagoon embankments with asphalt, and drilling monitoring wells around the site periphery to monitor groundwater quality).

SOILS AND CONSTRUCTION GEOLOGY

Soils at each site are evaluated on the basis of their permeability, suitability for construction of earthen dikes, and whether or not they are prime agricultural land. Since the soil excavated at the site would be used to construct and line the treatment and storage lagoons, their suitability for lining must be considered. If the native soils all have a high permeability then the problem of leakage from the lagoons will be more severe. If the soils are unsuited to construction of earthen berms then soil will have to be imported for this purpose and the native soil disposed of elsewhere, thus increasing the cost of construction. Finally, it is desirable to build the proposed facility on soils which are not prime agricultural land since the land will be removed for the life of the project from agricultural production. Information for evaluating the above parameters was obtained from References 1 and 2.

All four sites have very similar soil characteristics. The predominant soils are clay loams, with permeabilities that range from 0.06 to 2.0 inches per hour. However, during tests of soil samples obtained from Site 10, permeabilities considerably lower than these values were obtained (4). Bedrock consisting of predominantly claystone with interbedded layers and lenses of sandstone and claystone-siltstone was encountered at depths of 3 to 16 feet (4,12). The soil engineering report for Site 10 indicated that material at the site would be suitable for construction of the proposed lagoon dikes, and that bedrock could probably be excavated by a truck-mounted ripper. The report further indicates that most or all of the excavated bedrock could be broken into small enough pieces to be used as embankment fill (4).

Based on the Adams and Weld County soil surveys (1,2) and on driller's logs of wells drilled in the area (3) it appears that subsurface conditions at Sites A, B and C are quite similar to those at Site 10. Well logs indicate that bedrock under Sites A, B and C ranges from 45 to 50 feet deep. The overlying material is mostly clay with up to a two foot layer of topsoil. Construction of the lagoons would be somewhat easier if bedrock were not encountered in any excavation such as is expected at Site 10; in addition, the possibility of lagoon seepage finding its way into the Arapahoe Formation would be reduced. There is no way to verify the depth to bedrock at these sites without exploratory drilling as was done at Site 10.

The construction suitability of the soils appears to be quite similar at all the sites. Using proper construction techniques and care in selecting excavated material to be used for embankment fill, the geological report on Site 10 concluded that the native excavated material could be used. There is no reason to believe that the soil at the other three sites will be any less suitable.

The construction of the embankment requires coarse aggregate in the drain blanket. This material could be obtained at Site 10 from the excavated bedrock material. If bedrock is not encountered at the other three sites, coarse aggregate material would have to be imported for construction. Without detailed analysis of the quantities of material required, it is uncertain whether the cost of importing aggregate at Sites A, B and C would be less than the cost of excavating the bedrock at Site 10.

All four sites were classified as prime agricultural land, if irrigated. At present, all are used for agricultural purposes, with varying amounts of irrigation on each. There is no significant difference between any of the sites with regard to this parameter.

TOPOGRAPHY AND FLOODING

Each site was evaluated on the basis of its general topography and the potential for flooding. The slope of the land will affect both the ease of lagoon and reservoir construction and the visual impact of the lagoons. A site with a large amount of relief would require a greater construction effort and would have a greater visual impact than one on flat terrain. Sites with a high possibility of flooding should be avoided.

All four sites are very similar with regard to slope and flooding potential. Site B does not have any slopes greater than 3 percent, Sites A and 10 both have some slopes up to 5 percent, and Site C has some slopes up to 9 percent. These slopes are not excessive and would not pose any construction problems. All will require approximately the same amount of excavation and embankment construction. Because the topographic features at all four sites are so similar, the visual impact of the facility will be approximately the same at any of the sites.

None of the sites is subjected to a severe flooding hazard. Sites B and C both have a moderate flooding hazard. Site B is located directly downslope of McKay Lake (see Figure F-1) and could be subject to flooding due to overflow or levee breaking. Site C is located adjacent to a drainage ditch which would flow along its north border; high flows in this ditch would subject Site C to possible flooding. Sites A and 10 have little or no potential for flooding.

CURRENT LAND USE

All four sites are presently used either for pasturage or for growing crops. Sites A, B and 10 have no residences on them while Site C has one residence which would have to be relocated. The sites in Adams County (A, B and C) are all zoned A-3: agricultural with a minimum ownership of 35 acres. Site 10 in Weld County is zoned Agricultural.

Land use practices in the area around the proposed sites are rapidly changing. Several nearby parcels of land have recently been subdivided and now contain single-family dwellings on one to five acre lots. At least 20 houses are within a half-mile radius of each of the sites, and Site B has as many as 80 residences within one-half mile. Because of recent developments in the area, it is likely that in the near future residential growth will occur in the vicinity of all sites. Site C is bounded on the east side by I-25 which would preclude any development of homes adjacent to the facility on that side. None of the other sites has any physical barriers to development around them.

Site C is slightly less desirable than the others because one household would have to be relocated. Otherwise, the agricultural use of all four sites makes them equally suitable for the proposed facility. It would be preferable aesthetically to select a site that has very few residences around it; unfortunately, rapid growth of residential housing within the study area has made this impossible. Site C may be preferred because its proximity to the interstate highway may partially mitigate aesthetic impacts on nearby residences.

PROXIMITY TO BULL CANAL

Water will, at different times, flow into and out of Bull Canal from the storage reservoir; therefore, close proximity to the canal will facilitate these water transfers. However, unless the distance is great, this factor is not a major constraint. Site 10 is the closest to the canal, the outlet structure being approximately 50 feet from the canal. Sites A, B and C are approximately 200, 900, and 300 feet from the Bull Canal, respectively. Sites A and 10 would operate alike with regard to water transfer; i.e., water being pumped from the reservoir to the canal, and flowing by gravity the other way. Sites B and C would have water pumped from the Bull Canal to the reservoir and flow by gravity from the reservoir to the canal.

It appears that Bull Canal flows and effluent management would be slightly easier at either Site A or Site 10 than at Sites B and C. However, management at any of the sites would not be particularly difficult and this factor alone is not sufficient for rejection of Sites B or C.

COSTS

The total cost of the wastewater collection and treatment component of the proposed Northglenn Water Supply and Wastewater Treatment System on Site 10 is estimated to be $30,242,300 (16). This includes collection system modifications, the force main to the treatment site, facilities construction, land costs, and engineering, legal and administrative costs. All of the costs involved in collection of wastewater, including the cost of the pump station, would remain approximately the same no matter which site was selected for the treatment and storage facility. Because the topography, soils and geology of Sites A, B, and C are similar to those at Site 10, facility construction costs at each site would be expected to be similar. Costs for fixed components (collection and construction) are estimated to be $28,366,900. The cost of the force main and land costs would change with the selection of a new site.

In addition, because a final design has been prepared for the proposed facility at Site 10, additional engineering costs would be incurred in changing to a new site. Finally, selection of a new site would result in delays to the project. A comparison of costs resulting from relocation of the facility are presented in Table F-2.

Sites A, B, and C are closer to Northglenn than Site 10 and the shorter distance would result in a shorter and less costly force main. Cost of the force main to Site 10 is estimated to be $1,729,000. Selection of Sites A, B or C could result in a force main 83 percent, 76 percent, and 78 percent respectively, as long as the force main to Site 10. Construction costs of the force main could be reduced proportionately to $1,433,800 for Site A, $1,307,300 for Site B, and $1,349,500 for Site C. Although Sites B and C are about 50 feet higher than Site 10, it is estimated that the cost of pumping the wastewater a shorter distance would compensate for the cost of raising it to a higher elevation.

The land at Site 10, 320 acres, was acquired several years ago for a total cost of $146,400 or $457.50 per acre. Since then, land prices have increased several fold. Four pieces of land presently for sale and located close to the proposed facility sites (Figure F-4) range in price from $2,500 to $5,000 per acre (17,18,19,20). Acquiring the land for Sites A, B and C at a cost of $3,800 per acre would cost $725,800, $931,000, and $672,000 respectively. However, if a new site were selected, Site 10 could be sold. If it sold for only $2,500 per acre, the credit would be $800,000, more than offsetting the costs for Sites A or C and $131,000 less than the cost of Site B.

As of 21 January 1980, $235,423 had been allocated for construction management of the wastewater system, and $37,215 had been spent for wastewater reimbursables or contingencies (16). These costs not only are unrecoverable, but an equal amount would probably have to be expended again if a new site were selected. In addition, $513,000 worth of engineering has gone into the final design plan for Site 10. However, it is estimated that with an expenditure of about $100,000 the Site 10 design plan could be modified to fit any of the other three alternative sites (22). Unrecoverable costs and additional engineering costs to move the facility to Sites A, B or C are therefore estimated to be approximately $375,000.

In March 1979, the City of Northglenn estimated that relocating the treatment facility would cause a delay of 465 days and would cost at least $2,500,000, including inflation, lost revenues, aquisition of a new site, and facility redesign (21). This analysis does not include inflation or loss of revenue. The cost of building a shorter force main to any of the alternative sites plus the credit for selling Site 10 to buy one of the alternative sites would partially compensate for unrecoverable costs and additional engineering costs involved in changing sites. If delay costs in changing to a new site are not considered, little difference exists between costs in keeping the facility at Site 10 and relocating it to any alternative site.

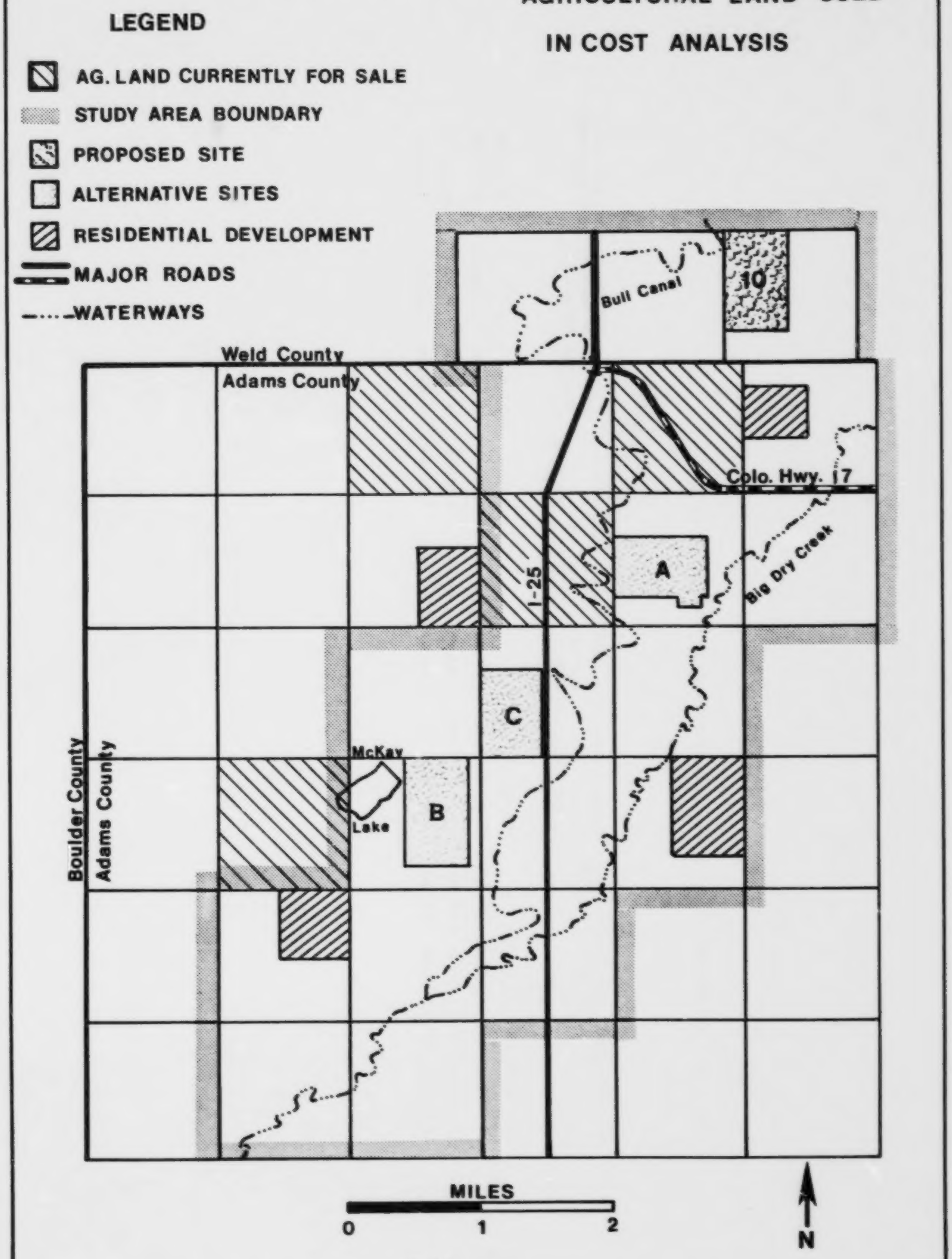
TABLE F-2 COSTS RESULTING FROM RELOCATION OF NORTHGLENN WATER TREATMENT AND STORAGE FACILITY

SITE	FIXED COSTS ($)	FORCE MAIN		LAND					UNRECOV. & ADDITIONAL ENG. COSTS ($)	COST CHANGE OF RELOCATING FACILITY SITE ($)	ESTIMATED COST OF WASTEWATER PROJECT ($)
		Site Cost ($)	Cost Change ($)	Site 10 Cost ($)	Site Size (Acres)	Site Cost $3800/Ac. ($)	Site 10 Selling Credit $2500/Ac. ($)	Cost Change ($)			
10	28,366,900	1,729,000	0	146,400	320	-	-	0	0	0	30,242,300
A	28,366,900	1,433,800	- 295,200	-	191	725,800	800,000	- 74,200	+ 375,000	5,600	30,247,900
B	28,366,900	1,307,300	- 421,700	-	245	913,000	800,000	+ 131,000	+ 375,000	84,300	30,326,600
C	28,366,900	1,349,500	- 379,500	-	177	672,600	800,000	- 127,400	+ 375,000	- 131,900	30,110,400

SOURCE: Engineering-Science, Inc.

FIGURE F-4

AGRICULTURAL LAND USED IN COST ANALYSIS


LEGEND
▧ AG. LAND CURRENTLY FOR SALE
▒ STUDY AREA BOUNDARY
▨ PROPOSED SITE
☐ ALTERNATIVE SITES
▨ RESIDENTIAL DEVELOPMENT
MAJOR ROADS
WATERWAYS
Weld County
Adams County
Bull Canal
10
Colo. Hwy. 17
I-25
A
Big Dry Creek
C
McKay
Lake
B
Boulder County
Adams County
MILES
0
1
2
N

CONCLUSIONS

All four sites are environmentally suited for construction of Northglenn's proposed wastewater treatment and storage facility based on this evaluation. Differences do exist between Sites A, B, C and 10 in the evaluation criteria, but these differences are believed to be insignificant and can be mitigated by construction techniques and monitoring. Advantages one site may offer for any given criterion can be balanced by advantages another site offers for another criterion.

It is recognized that time and money has been committed to the development of Site 10 and that relocation from this site would result in some loss of this commitment. However, based on this initial analysis, credits gained due to a shorter force main and land sales could partially offset the expenditures to date. It is not known whether these gains could offset the loss of bond revenue and effects of inflation. If only direct costs and environmental aspects are considered, all four sites are equally suited for the proposed project.

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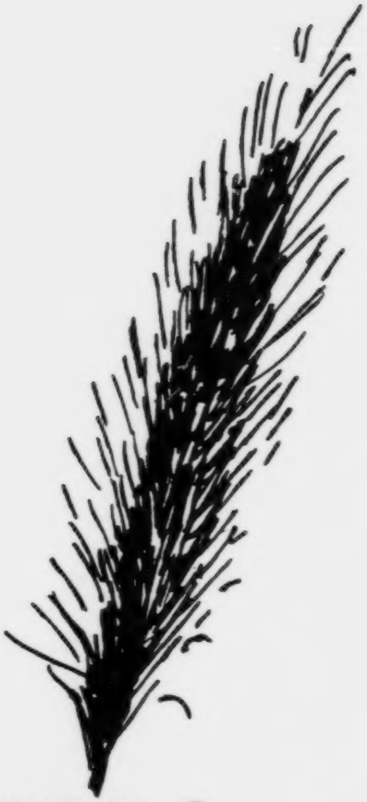


APPENDIX G

ANALYSIS OF CHANGES IN AGRICULTURAL PRODUCTIVITY

AGRICULTURE IN THE STUDY AREA

Agriculture is an extremely important industry in the State of Colorado, including the FRICO and Lower South Platte portions of the study area. Due to urban encroachment, land development, changes in land policies and erosion, Colorado has lost six percent of its productive land in the last two decades.(1) Along the Front Range, irrigated cropland decreased from 700,000 to 660,000 acres between 1959 and 1978.(1) In view of the potentially critical impact nationwide of the reduction in agricultural land, the current EPA policy is "... to protect... the Nation's environmentally significant agricultural land from irreversible conversion to uses which result in its loss as an environmental or essential food production resource."(2) Consequently, a key issue in the evaluation of the proposed Northglenn Water Management Program is its potential impact on agriculture.

Conceptually, the intent of the Northglenn Plan is to minimize the impact on agriculture by providing water to the City via a scheme of water reclamation and exchange in lieu of condemnation. To understand the implications of the proposed plan as it relates to agriculture, it is necessary to first examine the soils, irrigation practices, crops, and current productivity of the agricultural lands in the study area.

Soils and Soil Productivity

The USDA Soil Conservation Service (SCS) has conducted detailed soil surveys in the region. The soils survey for Southern Weld County is, however, unpublished at the present time. The major soils within the study area have a textural range from sandy loams to clay loams, with minor areas identified as clays and sands. Soils of the region generally reflect the Tertiary and Pleistocene sediments at the eastern edge of the Rocky Mountain system, with minor sediments derived from the Denver and Arapahoe Arkose formation. Recent alluvium deposits occur along major stream valleys. Soils can generally be grouped into the high terrace and alluvial fan soils, old terrace and plains soils, ridgecrest and slope soils, upland soils, floodplain soils, and the sandhill area soils.

Natural soil fertility is low within the survey area. Nitrogen, and to a lesser degree phosphorus, are needed for best crop production in the irrigated areas. Zinc and iron are the only nutrients known to be deficient in many of the soils.(3.4) Most irrigation water contains enough of the minor elements to meet the annual requirements of commonly grown crops.

Soil capability classifications used by the SCS are interpretative groupings made primarily for agricultural purposes. In this classification, the arable soils are grouped according to their potentialities and limitations for sustained production of the commonly cultivated crops. Thus, the most productive soils under irrigation have Class I capability ratings, whereas those with limitations are rated with larger Roman numerals. Class I soils have few, if any, limitations and Class III soils have moderate limitations which reduce the choice of crops or require moderate conservation practices. Class IV, Class V and Class VI soils have limitations which make them generally unsuited for cultivation, and limit their use largely to pasture or range. Potential flooding, uneven topography, excessive rock or tree cover, seasonal high water tables, drainage problems, inadequate depth to bedrock, excessive slope, and clay subhorizons are the reasons for poor ratings. The major irrigated soils within the study area are identified as Class II and Class III soils, with minor areas rated as Class I, Class IV and Class VI.

Prime Farmlands

With the assistance of the Colorado State University Experiment Stations, the USDA Soil Conservation Service has also undertaken the task of identifying and mapping farmlands of national, statewide and local importance. The result of these efforts is a series of Important Farmlands Maps. In general, lands identified on the maps as "Prime Farmlands" (see Figure G-1) have an adequate and dependable water supply from irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. In addition, these lands are permeable to water and air, are not excessively erodible or saturated with water for long periods of time, and either do not flood frequently or are protected from flooding. As illustrated on Figure G-1, the vast majority of the lands included in this study (both FRICO and South Platte) have been designated "Prime Farmlands."

Irrigation Practices in the Study Area

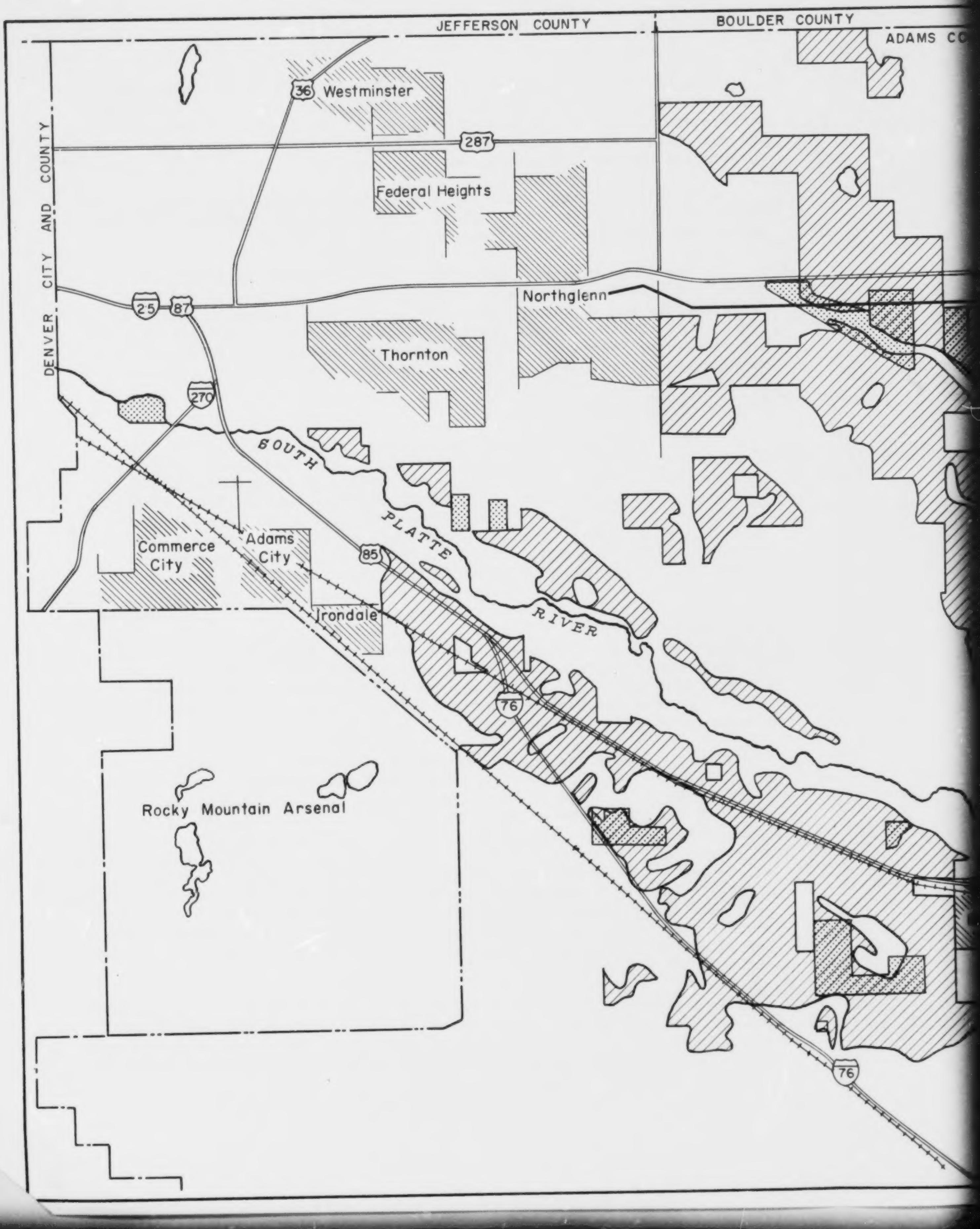
All methods of irrigation are suitable for the soils within the study area except where slope is a limiting factor. Furrow irrigation is most common.

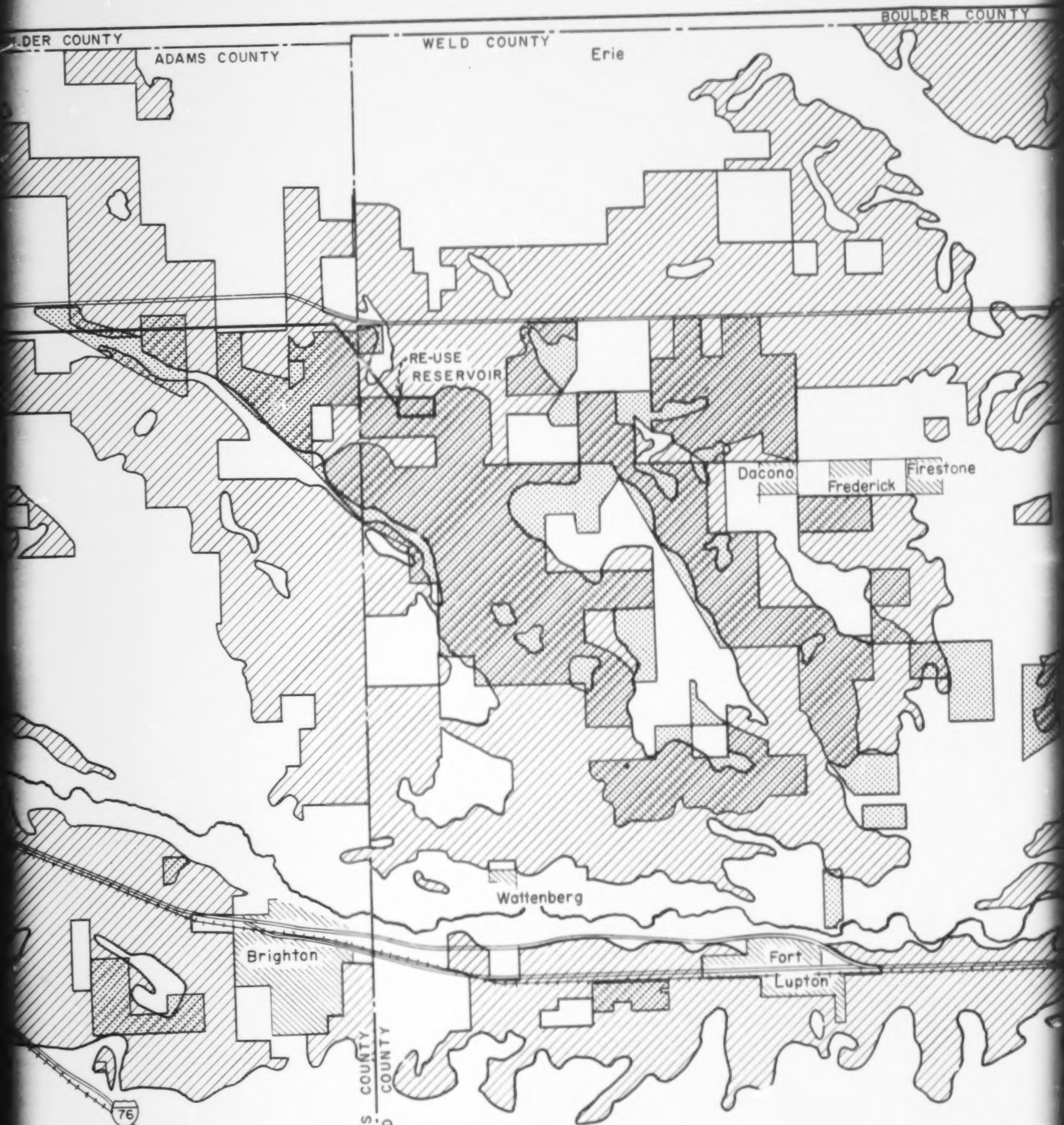
Furrow irrigation is accomplished by gravity flow of water in narrow channels fed by a head ditch. Water seeps into the soils from the sides and bottom of the furrows. Water is introduced into each furrow by a siphon tube from the head ditch. Crops commonly irrigated in the area are alfalfa, corn, sugar beets, barley, field beans and small vegetables.

Where slope is a limiting factor, contour ditches, corrugations, contour furrows, cross-slope furrows, and sprinklers are used. At least one center pivot sprinkler is used in the study area. According to the Weld County Extension Service,(5) there is a trend to replace furrow irrigation with sprinklers. The two major reasons for this trend are to increase water application efficiencies and to decrease labor cost.

Cropping Patterns

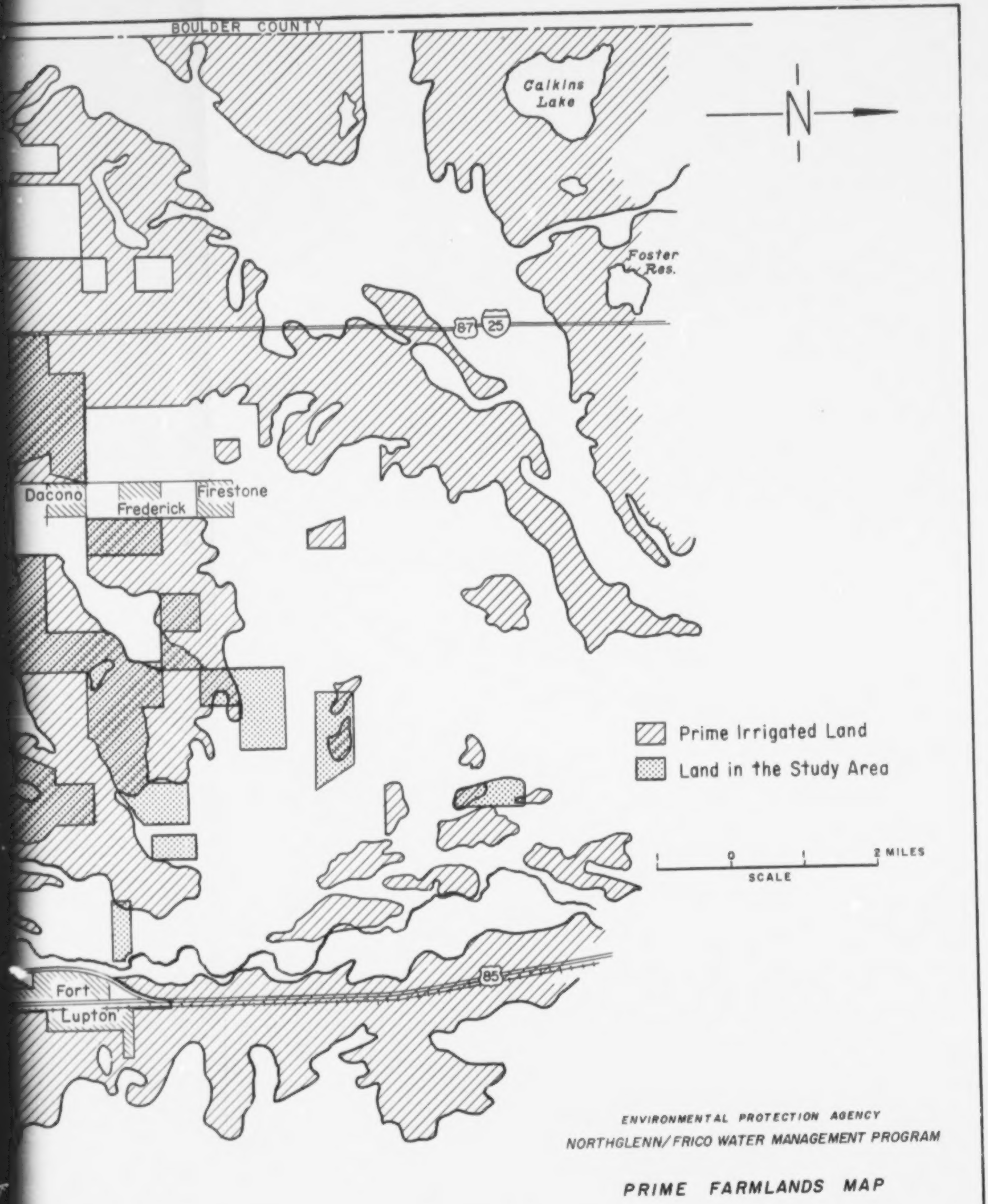
The irrigated farmland within the study area produces a wide variety of crops. The main crops are corn for grain and silage, alfalfa, sugar beets, and field beans. A common cropping system is a 3 to 4 year rotation of alfalfa followed by corn for grain, corn for silage, sugar beets and small grains of field beans. This type of rotation allows maximum use of available soil nutrients. Malt barley and certain truck crops are also grown on limited acreages within the study area.


JEFFERSON COUNTY
BOULDER COUNTY
ADAMS CO
DENVER CITY AND COUNTY
36
Westminster
287
Federal Heights
25
87
Northglenn
Thornton
270
SOUTH PLATTE RIVER
Commerce City
Adams City
85
Irondale
76
Rocky Mountain Arsenal
76



BOULDER COUNTY
ADAMS COUNTY
WELD COUNTY
Erie
BOULDER COUNTY
RE-USE
RESERVOIR
Dacono
Frederick
Firestone
Wattenberg
Brighton
Fort
Lupton
ADAMS COUNTY
WELD COUNTY
76

FIGURE G-1


BOULDER COUNTY
Calkins Lake
N
Foster Res.
87
25
Dacono
Frederick
Firestone
Fort Lupton
85
▨ Prime Irrigated Land
▒ Land in the Study Area
1 0 1 2 MILES
SCALE

ENVIRONMENTAL PROTECTION AGENCY

NORTHGLENN/FRICO WATER MANAGEMENT PROGRAM

PRIME FARMLANDS MAP

Most of the corn grown in the area is used for feed at commercial feedlots, farm feedlots, and dairies. Significant numbers of sheep and turkeys are raised on the feed crops grown in the area.(3) Sugar beets and malt barley crops are commonly contracted for by Great Western Sugar Corporation and Coors Brewery, respectively.

A rotation of small grain and summer fallow is the main type of farming on the non-irrigated acreage. Wheat is the principal dry-farm crop, but barley and sorghum are also grown.

In the 27 year period from 1950 to 1977, Colorado Agricultural Statistics(6) show an increase in the acreage plated in corn and wheat. Barley, field beans, sugar beets, and sorghum have gradually declined since 1950. During the same period of time, however, yields per acre for all crops have increased. This may be attributed to more efficient farm management practices and advanced technology in agricultural practices.

Present Agricultural Productivity

Estimates of the crop yields for lands which may be removed from agricultural production under the Northglenn Water Management Plan have been developed. Table G-1 indicates the estimated irrigated and non-irrigated acreages of crops grown in the Standley Lake Division of FRICO in 1979. Table G-2 lists the estimated crop yields and crop values for those lands in 1979. The total value of crops produced from irrigated lands in the Standley Lake Division of FRICO in 1979 was approximately $1,922,000. According to information obtained from FRICO, Standley Lake releases in 1979 totalled 14,425 acre feet. Assuming that 60 percent of the releases were delivered to the farm headgate, the 1979 farm headgate deliveries amounted to 8655 acre feet. Given an irrigation efficiency of 65 percent, the consumptive use of irrigation water on the 8345 acres of FRICO land irrigated in 1979 was approximately 5626 acre-feet. The average productivity of irrigated land in the Standley Lake Division of FRICO was therefore $230 per acre in 1979, or $342 per acre-foot of consumptive use of irrigation water.

This average producitivity of $342 per acre-foot of consumptive use of irrigation water does not represent the actual value of water. Rather, it represents the value of the crops produced on FRICO land per acre-foot of water consumed. The value of the crops is the economic return on a number of resources including water, labor, capital, machinery, fertilizer, and other inputs. Water delivered via irrigation, of course, is not sufficient in the absence of these other resources for crop production; therefore, water is not solely responsible for the value of the crop. In the following analysis, it is assumed that these other resources are equal for FRICO and South Platte lands. On the basis of this assumption, the average productivity per acre-foot of consumptive use provides a relative indicator of the value of water in the two systems.

The consumptive use of irrigation water in the FRICO system was approximately 0.67 acre-foot per acre in 1979. As this is significantly lower than the potential consumptive use of most crops, the question arises as to how FRICO farmers are able to achieve their current level of production

TABLE G-1

ESTIMATED DISTRIBUTION OF IRRIGATED AND NON-IRRIGATED AREAS WITHIN FARMERS RESERVIOR AND IRRIGATION CO., STANDLEY LAKE DIVISION IN 1979

CROP	AREA (ACRES)*			PERCENTAGE OF TOTAL AREA		
	IRRIGATED	NON-IRRIGATED	TOTAL	IRRIGATED	NON-IRRIGATED	TOTAL
Corn (Grain/Silage)	4,850	0	4,850	32	0	32
Alfalfa	1,970	0	1,970	13	0	13
Spring Wheat	0	1,033	1,033	0	7	7
Winter Wheat	0	834	834	0	5	5
Barley	767	700	1,467	5	5	10
Sugar Beets	606	0	606	4	0	4
Field Beans	152	0	152	1	0	1
Fallow	0	3,031	3,031	0	20	20
Dairy	0	62	62	0	1	1
Non-Agricultural	0	1,151	1,151	0	7	7
TOTAL	8,345	6,811	15,156	55	45	100

*Estimated from planimetering maps of cropping pattern in 1979 within Farmers Reservoir and Irrigation Co., Standley Lake Division.

TABLE G-2

ESTIMATED 1979 CROP VALUE

IN FRICO STANDLEY LAKE DIVISION

Crop	Yield Per Acre[1]	1979 Market Value[2]	Crop Acres	Crop Value[3]	
				Irrigated	Non-Irrigated
Alfalfa	3.06 ton	$ 49.50/ton	1,970	$ 298,000	$
Corn (grain)	74 bu	2.74/bu	3,395[3]	688,000	
Corn (silage)	17 ton	18.31/ton	1,455[3]	453,000	
Sugar Beets	19 ton	29.00/ton	606	334,000	
Field Beans	27.5 bu	10.00/bu	152	42,000	
Barley (irrigated)	52.9 bu	2.64/bu	767	107,000	
Barley (non-irrigated)	16.5 bu	2.11/bu	700		24,000
Wheat (non-irrigated)	16.5 bu	3.76/bu	1,867		116,000
			10,912	$ 1,922,000	$140,000

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[1] Estimates based on information contained in CSU Environmental Resources Center Completion Report No. 75 entitled Physical and Economic Effects on the Local Agricultural Economy of Water Transfer to Cities, (7), and personnel interviews with FRICO farmers.

[2] From Northern Feed and Bean, Western Alfalfa Corp., Farmers Marketing Association, Monfort Farms, Coors Brewery and Great Western Sugar Co.

[3] Assume 70 percent of corn to be harvested as grain and 30 percent as silage.

with such a limited water supply. A significant portion of the consumptive use requirement of the crop is met from soil moisture stored in the soil profile during the winter and spring months, and from effective precipitation during the growing season. The soils in the FRICO area are predominantly fine textured and trend to a clay loam classification. These soils have a high field capacity, and the readily available soil moisture is on the order of 2 inches per foot of root depth. The soil moisture is utilized by the crop during the growing season when the irrigation application and effective precipitation are not sufficient to meet the consumptive use requirements. In addition, the crop mix of short-season crops such as barley and wheat with long-season crops allow the farmer some water management flexibility wherein he may apply less water per acre on the short-season crops and apply more on corn and alfalfa. It therefore appears that the moisture from the three sources, when judiciously applied to the crops in the present cropping pattern, is adequate to produce the yields reported in the FRICO system.

Implementation of the Northglenn Water Management Plan may result in the removal of certain lands along the South Platte River from irrigated agricultural production. Table G-3 summarizes the acreages, yields and values of crops produced on these South Platte lands. The total value of crops produced on the 1396.5 acres of irrigated land is approximately $553,000. Based on depletion studies conducted by Wright Water Engineers, Inc., the consumptive use of water from the South Platte ditches which would occur as a result of irrigating this land is 2135.6 acre-feet in an average year. The productivity of the land served by the South Platte ditches is therefore approximately $396 per acre of land, or $259 per acre-foot of consumptive use of irrigation water. (Note: In computing the total crop value for lands in the South Platte system, the production of 28.4 acres of pasture grass was neglected. This alone would result in a slight underestimation of the crop value per acre-foot of consumptive use; it is assumed, however, that this factor is "balanced" by the fact that well water is occasionally used to supplement the irrigation water supplied by the South Platte ditches. The total consumptive use of irrigation water, therefore, may be somewhat higher than the consumptive use of ditch water indicated above.)

For purposes of analyzing the impact of Northglenn's plan on agricultural productivity, it is assumed that the dry land agricultural productivity of both FRICO and South Platte lands is $60 per acre annually. This assumption may be somewhat generous, particularly with regard to the South Platte lands; it also neglects the fact that a transition period of about five years is required after removing a parcel from irrigated agriculture before it can produce at an acceptable level using dry-farming techniques.

There is an inconsistency between the productivities of FRICO and the South Platte for particular crops. It has been noted that the yields of corn (grain) are 53 percent higher in the South Platte than in FRICO while corn (silage) yields are 19 percent higher in FRICO than in the South Platte. The yields for the South Platte irrigated lands are for Adams County. From reviewing the existing irrigated land maps of Adams County it is obvious that the major irrigated areas are along the South Platte River, therefore, it is valid to use the County average yield for the study area.

TABLE G-3

ESTIMATED CROP VALUE-SOUTH PLATTE RIVER

IN 1979 DOLLARS

Crop	Yield Per Acre[1]	1979 Market Values[2]	Crop Acres[3]	Crop Value Irrigated
Alfalfa	4.2 tons	$ 49.50/ton	602.4	$125,200
Small Vegetables	-	1,000.00/acre	240.6	240,600
Corn (grain)	140.0 bu	2.74/bu	198.4	76,100
Corn (silage)	13.8 tons	18.31/ton	123.1	31,100
Sugar Beets	18.6 tons	29.00/ton	111.8	60,300
Field Beans	23.6 bu	10.00/bu	48.5	11,400
Barley (irrigated)	43.6 bu	2.64/bu	71.7	8,300
			1,396.5	$553,000

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[1] Estimated historic yields based on current market value of crops and information provided by Colorado Agricultural statistician, Lance Fretwell and A. Watada, Executive Board Member, Consolidated Ditches - South Platte River.

[2] Northern Feed and Bean, Western Alfalfa Corp., Farmers Market Association, Monfort Farms, Coors Brewery and Great Western Sugar Company.

[3] Wright Water Engineers, Inc. City of Northglenn South Platte Augmentation Plan, Engineering Report, March 31, 1980.

The yields of crops produced in FRICO were not available for the specific study are from County, State, or Federal agencies. The most definitive data were available from work done by Dr. Ray Anderson(7) and by personnel interviews with FRICO farmers.

The relative variations in crop yields, particularly the corn (grain) and corn (silage) anomaly, is consist with the Adams County and Weld County yields for these crops as reported in the 1979 Agricultural Statistics for Colorado.

This variation in yields is believed to be a consequence of the following:

- FRICO initially plants corn for grain, but because of water short conditions crops are often marketed as silage. (Corn for grain can not be marketed profitable).
- South Platte plants corn for grain on areas with better soil and abundant water and corn for silage on poor soil with less available water.

IMPACT ON AGRICULTURAL PRODUCTIVITY

The Northglenn Water Management Program is, as its title suggests, a plan for the allocation of a scarce and valuable natural resource - water. Because the key element in this plan is water, its impact on the agricultural productivity of the lands it affects is examined from the standpoint of consumptive use of irrigation water. In 1979, the productivity of FRICO lands was approximately \$342 per acre-foot of consumptive use of irrigation water; the comparable value for South Platte lands is estimated at \$259 per acre-foot.

Four options within the basic framework of the Northglenn Water Management Plan have been examined to determine their impact on total agricultural production in the study area. The option which contemplates acquisition of sufficient water to meet Northglenn's needs via purchase or condemnation of FRICO shares and treatment of wastewater at the Metro Denver Plant (Option 4) shall be used as the "baseline" to which the agricultural impacts accompanying all other planning options will be compared.

Water Availability to FRICO

The amount of water available to the FRICO farmers is dependent on the option chosen. The estimated farm headgate delivery for each of the options is summarized in Table G-4. This analysis ignores any benefits due to lining of the Bull Canal.

TABLE G-4

ESTIMATED FRICO FARM HEADGATE WATER DELIVERIES

Option	Description	Water (Acre-Feet)(1) Average Year	Water (Acre-Feet)(1) Dry Year
1	Without deep wells	6390[2]	4706
2	650 acre-feet from non-tributary wells	6390[2]	4667
3	2300 acre-feet from non-tributary wells	6390[2]	4650[2]
4	Water from Standley Lake Wastewater to Metro	3572	788

(1) Equal to 70% of sum of FRICO exchange return and release from Standley Lake (see Figures 3-1 through 3-4).

(2) Under these conditions there is also excess water over repayment requirement available to irrigate Northglenn owned lands.

Augmentation Water

Based on data set forth in Northglenn's Water Budget (see Table 4-2, Main Report), the required augmentation water from surface sources for the four options evaluated is summarized in Table G-5. Some of the augmentation water will come from lands currently in production. To determine the impact of each option on agriculture, only that water to be taken from lands currently in production is of consequence.

TABLE G-5

SURFACE WATER AUGMENTATION

Option	Description	Total Required (acre-feet) Average Year	Total Required (acre-feet) Dry Year	Water Removed From Currently Productive Agricultural Land (acre-feet of consumptive use) Avg. Year(1)	Water Removed From Currently Productive Agricultural Land (acre-feet of consumptive use) Dry Year(2)
1	Without deep wells	0	1646	1667	1520
2	650 acre-feet from nontributary wells	0	936	888	810
3	2300 acre-feet from nontributary wells	0	0	0	0
4	Water from Standley Lake Wastewater to Metro	0	0	0	0

(1) It is Northglenn's intention to remove the same amount of land from agricultural production in an average year as would be necessary in a dry year. The average year consumptive use associated with that land is indicated above (2039.2/1859.3 x dry year consumptive use). This excess water would be available for irrigation of Northglenn owned land.

Note: 2039.2 and 1859.3 are the respective average and dry year consumptive use values (in acre-feet) attributable to the South Platte land which are currently in irrigated agricultural production. Source: Wright Water Engineers, Inc.

(2) Figures obtained by subtracting dry year consumptive use of currently out-of-production land (126 acre-feet) from Total Required.

Agricultural Productivity under the Northglenn Plan

The individual and combined gross agricultural productivities for FRICO and South Platte lands under each of the four options considered are presented in Table G-6. Anticipated productivities of the irrigated FRICO lands were computed using the farm headgate deliveries indicated in Table G-4, assumed irrigation efficiencies of 65 percent in an average year and 70 percent in a dry year, and an estimated production value of $342 per acre-foot of consumptive use of irrigation water. Average application rate in the FRICO system is 1.04 acre-feet of farm headgate delivery per acre of land. Under each option, remaining non-irrigated land in the FRICO service area (total area = 15,000 acres) was assumed to have a dry-farming productivity of $60 per acre. The FRICO productivities in Table G-6 represent the sum of the productivities of irrigated and non-irrigated land in the FRICO system.

South Platte productivities of irrigated land were calculated by subtracting water required to be removed from currently productive agricultural land (Table G-5) from total consumptive use attributable to the 1343.4 acres of currently productive land (2039.2 acre-feet in an average year and 1859.3 acre-feet in a dry year), and multiplying the differences by $259 per acre-foot of consumptive use of irrigation water. Land removed from irrigated agriculture was assumed to have a residual dry-farming productivity of $60 per acre. The South Platte productivities in Table G-6 represent the sum of the productivities of irrigated and non-irrigated land.

TABLE G-6

GROSS PRODUCTIVITY OF FRICO AND SOUTH PLATTE

IRRIGATED LANDS AFFECTED BY THE NORTHGLENN PROJECT

(IN MILLION DOLLARS)

Option	Description	FRICO[1]		SOUTH PLATTE[2]		TOTAL GROSS PRODUCTIVITY	
		Average Year	Dry Year	Average Year	Dry Year	Average Year	Dry Year
1	Without deep wells	1.95	1.76	0.16	0.15	2.11	1.91
2	650 acre-feet from non-tributary wells	1.95	1.75	0.33	0.31	2.28	2.06
3	2300 acre-feet from non-tributary wells	1.95	1.74	0.53	0.48	2.48	2.22
4	Water from Standley Lake Wastewater to Metro	1.49	1.04	0.53	0.48	2.02	1.52

[1] Based on $342/acre-foot of consumptive use of irrigation water. FRICO deliveries given in Table 4; irrigation efficiency = 65% in average year and 70% in dry year.

[2] Based on $259/acre-foot of consumptive use of irrigation water.

Note: All lands which are removed from irrigated agricultural production are assumed to have a dry-farming productivity of $60/acre.

The total gross productivity for Options 1 through 4 is the sum of the FRICO and South Platte productivities. It should be noted that additional water is available under Options 1 through 3 for possible irrigation of Northglenn owned lands - see footnotes, Tables G-4 and G-5.

The analysis uses an "average benefit" approach to analyzing the impacts of the Northglenn Water Management Program on agricultural productivity in the study area. A marginal benefit approach to productivity analysis would, in theory, be more technically sound. Such an approach recognizes that additional output (crop value) is not constant, but varies with the addition of incremental units of input (acre-feet of consumptive use of water). After careful consideration of the various theoretical and practical aspects of making this productivity analysis, however, EPA has concluded that use of average productivity parameters is adequate under these circumstances for the following reasons:

(1) It would be impractical, if not impossible, to collect the amount of data necessary to develop reliable estimates of the marginal productivity characteristics of the FRICO and South Platte systems;

(2) Lands being taken out of production will be completely deprived of irrigation water - consequently, there is no need to make a marginal benefit analysis with regard to withdrawal of water from the South Platte or FRICO lands.

(3) Under the bonus arrangement, the FRICO system is to receive some additional water under the first three options. It is impossible to predict whether this water would be spread over the land already irrigated, or used to bring additional acreage under irrigation.

(4) Land in the FRICO system can be categorized as "water short". It is reasonable to assume that it produces in a range in which the incremental output (crop value) attributable to the addition of successive increments of input (water) is relatively constant. The South Platte systems, on the other hand, generally has an adequate supply of water. It is likely that adding increments of water to the South Platte system would result in a series of diminishing returns. Consequently, when evaluating the economic effect of adding water to the "water short" area, the use of an "average benefit" approach yields a reasonable estimate of agricultural benefits.

Option 4 does not include consideration of any increased productivity along the South Platte due to the additional water that would be discharged to the River via the Denver Metro Plant (433 acre-feet per month). This additional water is less than three percent of the flow in the South Platte below the Metro Plant. It is unlikely that this flow would result in any noticeable increase in agricultural productivity in the study area, particularly in view of the fact that the South Platte ditches under consideration generally receive an adequate water supply. If the water was available to the South Platte ditches of concern it could be assumed to be available for the six months of the growing season. The maximum increased productivity along the South Platte for this additional water, based on $259 per acre-foot of

FIGURE G-2

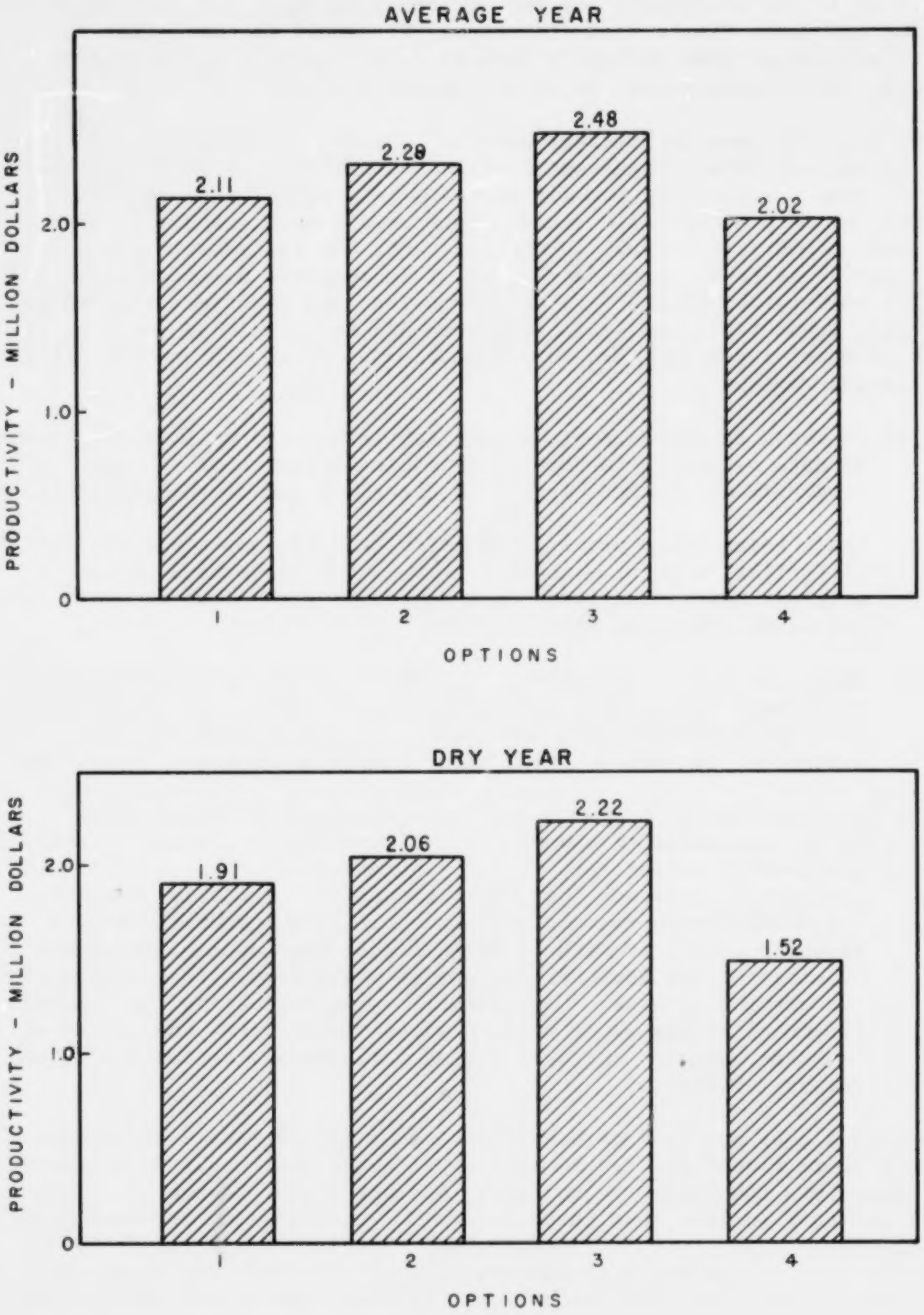

FIGURE 2

GROSS AGRICULTURAL PRODUCTIVITY

consumptive use would be $673,000 per year. Any increases in agricultural productivity beyond the confines of the study area were neglected.

As can be seen in Table G-6, the option that contemplates maximum use of nontributary groundwater (Option 3) results in the greatest agricultural productivity (least impact). Option 4 which contemplates Northglenn's acquiring its entire water supply from FRICO by purchase or condemnation with wastewater discharged to the South Platte results in the lowest agricultural productivity (greatest impact). Bar charts presented in Figure G-2 illustrate the gross productivities under the four options in both an average and dry year.

The gross productivity of the FRICO system shown in Table G-6 for Option 4 is based on the assumption that the small amount of water retained by the FRICO farmers would continue to produce a viable irrigation project. The assumptions regarding the ownership of stock in the FRICO system for the 4 options are shown in Table G-7.

TABLE G-7

OWNERSHIP OF STOCK IN FRICO SYSTEM

	Options 1, 2 and 3		Option 4	
Owner	Shares(1)	% of Ownership	Shares	% of Ownership
Westminister	438.23	18.5	438.23	18.5
Thornton	270.29	11.4	270.29	11.4
Northglenn	214.73	9.0	1,401.88	59.0
FRICO Farmers	1,449.75	61.1	262.60	11.1
	2,373.00	100.0	2,373.00	100.0

(1) Projected 1980 ownership

In Option 4 it is seen that Northglenn must control 59 percent of the shares in order to have an adequate raw water supply to meet the dry year condition. It is further seen that the FRICO farmers would only control 11.1 percent of the shares. Should the condemnation or purchase of additional shares by Northglenn be done in such a manner so that the remaining shares held by FRICO farmers were located in a patchwork pattern throughout the area, it is questionable that a viable irrigation system would remain. It is, therefore, very likely that under Option 4 the remaining shares, by economic necessity, would be sold to cities and irrigated agriculture would cease in the FRICO system.

CONCLUSION

EPA concludes from this analysis that under the exchange program, positive agricultural benefits are obtained if all the augmentation water is derived from deep wells (Option 3). If Northglenn implements an exchange which requires augmentation water entirely from other irrigators (Option 1), there will be some loss to agriculture, but productivity will be substantially higher than if Northglenn did not execute an exchange agreement (Option 4). EPA therefore concludes that compared to the situation wherein ongoing litigation would have been successful, the proposed exchange, regardless of the source from which Northglenn obtains augmentation water, has significantly less economic impact on agriculture.

The long term exchange agreement with FRICO enhances the likelihood that significant acreage of irrigated land will remain productive farmland during this century. In conclusion, EPA has determined that this plan meets EPA's policy to protect environmentally significant agricultural land, and therefore endorses this proposal.

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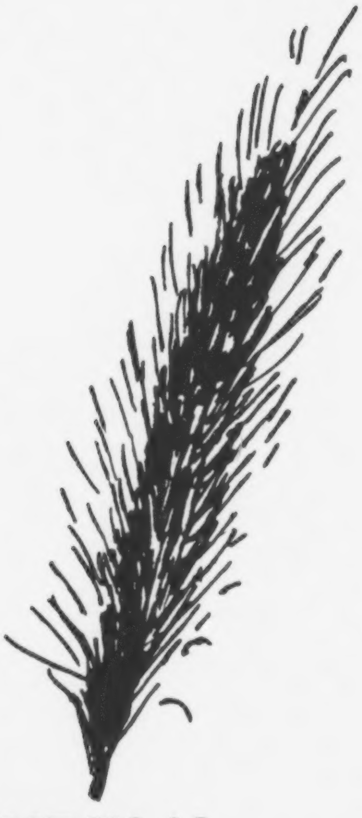
4. United States Department of Agriculture, Soil Conservation Service. Soil Survey of Adams County, 1974.
5. Personal communication. Stan Boyes, Weld County Extension Service. August 23, 1979.
6. Colorado Agricultural Statistics Bulletin, January 1978.
7. CSU Environmental Resources Center. Physical and Economic Effects on the Local Agricultural Economy of Water Transfer to Cities Completion Report No. 75.



APPENDIX H

REVIEW OF SLUDGE MANAGEMENT PLAN

APPENDIX H

REVIEW OF SLUDGE MANAGEMENT PLAN

Northglenn's proposed wastewater treatment and storage facilities are expected to produce stabilized sludge in the form of a settled six percent solids mixture in the bottom of the third lagoons. The physical and chemical quality of the sludge is expected to be suitable for land application as an agricultural nutrient. Northglenn intends to remove the collected sludge in the fall of each year from the lagoons and apply it to agricultural lands by plow injection at an approximate rate of five dry tons per acre per year. Northglenn intends to apply sludge to privately owned agricultural lands or to City-owned lands within or near its city limits or both. The net annual cost to the City for the plan will be approximately $5,000 per year, not including Federal grant assistance.

SLUDGE QUANTITY

Northglenn's original estimate of the annual sludge production rate was 895 dry tons per year in the form of 368,000 cubic feet of sludge consisting of 5 percent solids and 95 percent water. This estimate was later revised based upon operational data from a lagoon treatment system in Muskegon, Michigan. The revised estimate was 600 dry tons per year in 247,000 cubic feet of sludge with a 6 percent solids content. The revised estimate would require that sludge be applied to 120 acres of land each year at a 5 ton per acre application rate, while the original estimate would require almost 180 acres.

Because of the variation in the estimated quantities of sludge, and consequently the amount of land required; and doubts about the applicability of the Muskegon operational data, EPA performed the following independent calculation using conservative assumptions.

Q, wastewater treated = 4.64 million gallons per day

BOD_5, five-day biochemical oxygen demand = 200 mg/litre

TSS, total suspended solids = 190 mg/litre

VSS, volatile suspended solids (assumed 70% of TSS) = 130 mg/litre

Y, third lagoon cell yield coefficient = 0.5

The value of Y is probably high for the proposed system because Y decreases as mean cell residence time increases. A calculation of sludge production based upon BOD_5 has the following form:

$$S = \frac{Q(\text{days/yr})(BOD_5)(C)(Y)K}{2{,}000 \text{ lbs/ton}}$$

where:

S = weight of dry sludge in tons/yr
C = Percent conversion of BOD_5 to cell matter and gases
K = metric conversion factor, 8.34

in numerical form;

$$S = \frac{(4.64)(365)(200)(0.95)(0.5)(8.34)}{2{,}000}$$

$$= \underline{670} \text{ tons/year}$$

An estimate of sludge production based upon suspended solids takes the following form:

$$S = \frac{(TSS - VSS)(Q)(\text{days/yr.})(K)}{2{,}000}$$

in numerical form;

$$S = \frac{(190-133)(4.64)(365)(8.34)}{2{,}000}$$

$$= \underline{403} \text{ tons/year}$$

Based on the foregoing, an estimate of 600 dry tons per year appears reasonable given available information. These estimates should of course be refined as new information or actual operational data become available.

SLUDGE QUALITY

An accurate assessment of Northglenn's sludge quality cannot be made until after the installation and operation of the treatment lagoons. However, Northglenn wastewater is almost all domestic and therefore the sludge generated will be similar to typical domestic sludges. Table H-1 lists the range and mean concentration of constituents in municipal treatment plant sludges. The median concentration values would be indicative of domestic sludges. This is further reinforced by the results of a wastewater sludge assay of 45 Michigan communities with light to moderate industry and populations between 2,000 and 180,000 as shown in Table H-2.

The concentrations of nutrients and heavy metals will act as constraints to sludge use for agriculture. The median cadmium level shown in Table H-1 and the mean level shown in Table H-2 correspond to a reasonably conservative estimate of the expected cadmium levels in Northglenn's sludge. Actual levels would be expected to be consideraly lower given the city's complete lack of industry and limited commercial land use.

TABLE H-1

RANGE OF CONCENTRATION OF SLUDGE CHARACTERISTICS FOR NATIONAL SAMPLE OF TREATMENT PLANTS

	Sample Number	Range	Median	Mean
Total N (%)	38	0.5 - 7.6	4.8	4.9
Total P (%)	38	1.1 - 5.5	2.7	2.9
Total K (%)	37	0.08 - 1.10	0.38	0.46
Fe μg/g	38	0.1 - 4.0	1.0	1.1
Cu μg/g	58	85 - 2,900	970	940
Pb μg/g	57	13 - 15,000	300	720
Al μg/g	37	0.1 - 2.3	0.4	0.7
Cr μg/g	53	10 - 13,600	260	1,270
Cd μg/g	57	5 - 2,170	16	135
Mn μg/g	38	55 - 1,120	340	420
Ni μg/g	46	2 - 1,700	31	150
Zn μg/g		108 - 14,000	1,800	2,170

Source: Journal of Environmental Quality, Vol. 6, No. 2, 1977

TABLE H-2

WASTEWATER SLUDGE ASSAY FOR FORTY-FIVE MICHIGAN COMMUNITIES

Parameter μg/g of Dry Sludge	Sample Number	Range	Mean
Hg	45	0.1 - 56	5.1
Cr	45	22 - 30,000	1,575
Co	45	140 - 10,400	1,026
Ni	45	12 - 2,400	221
Fe	45	1,280 - 144,000	23,420
Zn	45	72 - 11,000	2,538
Cd	45	2 - 260	18
Pb	45	80 - 26,000	1,468
As	45	1.6 - 18	7.4

Source: Blakeslee, Paul A., Michigan Department of Natural Resources, 1973

The values presented are all within reasonable ranges for domestic sludge. EPA believes that levels for Northglenn sludge will be less than the mean values presented. However, sludge characterization studies should be conducted on sludge produced at Northglenn's wastewater treatment plant so that proposed sludge application rates can be appropriately revised.

REGULATORY ASPECTS OF SLUDGE DISPOSAL

The Northglenn facilities plan identified sludge application to agricultural land as the desirable ultimate disposal option. EPA has issued regulations concerning the land application of wastewater sludge (40 CFR, Part 257, September 13, 1979) which have a direct bearing on the Northglenn project. These regulations cover allowable cadmium levels and polychlorinated biphenyls (PCBs) levels in sludge, and pathogen control methods prior to land application.

Specifically, the regulations limit the annual loadings after 1987 of cadmium from sludge to less than 0.5 kilograms per hectare on land which may be used to grow crops for human consumption. In addition the pH of the soil-sludge mixture must be 6.5 or greater at the time of each sludge application. If the cadmium level in the sludge is less than 2 μg/kg (dry weight) these restrictions do not apply. The cumulative application of cadmium from sludge must not exceed certain levels based upon the soil's pH and cation exchange capacity (CEC) as shown in Table H-3.

The expected cadmium content of Northglenn's sludge can be estimated from Tables H-1 and H-2. If an average cadmium concentration of 18 μg/g is conservatively assumed, a corresponding maximum annual application rate of 12.4 tons/acre results. This application rate would result in the average annual nitrogen requirements of a typical grain crop (175 lbs/acre/year) to be exceeded, and would therefore not limit the sludge application rate.

TABLE H-3
MAXIMUN CADMIUM APPLICATION

Soil Cation Exchange Capacity	Maximum Cumulative Cadmium Application (kg/ha) Background Soil pH Less than 6.5	Background Soil pH More than 6.5
Less than 5	5	5
5 - 15	5	10
More than 15	5	15

Based upon nitrogen requirements, an annual application rate of five tons/acre/year would be reasonable. At this application rate EPA calculates that it would take 25 years to reach EPA's cumulative cadmium limit assuming worst case soil conditions (low pH and CEC) rather than 28 as calculated by Northglenn. Given typical soil conditions in Adams and Weld Counties (pH more than 6.5 and CECs between 5 and 15) EPA calculates that the cumulative limits would take 50 years to reach. EPA concludes that cadmium limitations with respect to agricultural land application of sludge will not be a problem in Northglenn's case within the 20-year planning period. Northglenn indicates that it is unlikely the same agricultural land will be used for sludge application for more than 15 to 20 years in any case.

EPA's regulations require that any sludge which is land applied must first be treated by a recognized Process to Significantly Reduce Pathogens (PSRP). The EPA's Municipal Environmental Research Laboratory (MERL) in Cincinnati recognizes the value of long-term lagoon retention of sludge as an acceptable PSRP, and has recommended to the Office of Solid Waste that lagoon retention of sludge for a period of eight weeks at temperatures around 20C would be acceptable, providing no new sludge or fresh wastewater is allowed to come in contact with the lagooned sludge during that eight-week period. With regard to long-term lagooning of sludge where contact with fresh wastewater or sludge is not restricted, it is the opinion of MERL that a significant reducton of pathogens may or may not be achieved depending on individual facilities circumstances. In the case of Northglenn's lagoon design, with sludge settling after five to fourteen days of suspension and aeration, the expressed opinion of MERL was that the system would probably achieve a significant reduction of pathogens without separate storage. Actual reductions achieved would be determined by monitoring the facilities.

EPA recognizes that regulations pertaining to a recognized Process to Significantly Reduce Pathogens are not currently clear as to acceptable processes for given treatment system. Northglenn has indicated that when final regulations are implemented compliance will be achieved.

If the eight weeks retention process is acceptable and Northglenn cannot achieve significant pathogen reduction, Northglenn proposes to alternately bypass each third cell for periods of up to eight weeks in order to achieve isolation of the retained sludge from fresh wastewater and sludge deposition. At the end of each eight-week period, the lagoon would be dredged and flow through the lagoon would be restored. During each bypass period, increased aeration would be provided in the remaining third cell to compensate for the lack of retention time. In addition, potable, submersible fixed film media surfaces, such as redwood racks, would be lowered into the third cell still in use to provide for increased nitrification rates through the increased concentration of nitrifying bacteria on the fixed surfaces.

EPA questions this operations strategy because the increased aeration of the third cell reduces settling and increases suspended solids carryover to the reservoir. Northglenn must provide further explanation of the impacts on treatment, the reservoir and effluent for this type of operation before EPA approval.

SLUDGE MANAGEMENT ALTERNATIVES

Northglenn's facilities plan identified land application of sludge to agricultural land as the preferred alternative. In the event that this alternative were to prove infeasible, an available contingency alternative would be to haul Northglenn's sludge to the proposed Denver Metro sludge disposal facility which is large enough to accommodate Northglenn's wastewater sludge volumes. Landfilling of sludge will not be a possibility as there are no landfills in Adams County which will accept wastewater sludge; all wastewater sludge produced in the County, including septic tank pumpings, is currently disposed of by the Denver Metro Lowry facility.

Northglenn's proposed sludge management alternative consists of sludge collection and stabilization in the treatment lagoons followed by land application. Sludge will settle in the third cells of the lagoons where it will be stored until removal. In the bottom of the third cells the settled solids will undergo continuous aerobic oxidation followed by anaerobic digestion as each layer of solids is gradually covered by succeeding layers. Sludge will be removed from the lagoons annually. Northglenn initially proposed to use a floating hydraulic dredge for sludge removal. However, recent discussions with Sheaffer and Roland indicate that this system will not be used in all probability. No system has been identified to replace the dredge system. Sludge removal is to occur over a two-month period in the fall of each year followed immediately with land application. Northglenn states that in case of adverse weather, spring application is possible.

Removed sludge will be pumped to a storage tank prior to transfer to tank trucks. The storage tank is necessary to allow continuous removal, thereby minimizing disturbances to the sludge blanket from surges due to multiple pump shutdowns and startups. Approximately 30,000 gallons of storage will hold a single day's application volume. Additional sludge thickening may occur in the storage tank and it is possible to drain supernatant back to the aerated lagoons. EPA believes that the amount of settling in the tank will be insignificant and any design consideration in terms of tank's size or characteristics of the sludge should not take this into account.

Northglenn proposes to use twin transport-applicator trucks with 5,000 gallon capacities to transport sludge from storage and to the proposed application sites. A rear-mounted plow, disk, harrow, or serrated coulter on the truck opens the surface of the field and sludge is injected immediately behind the opening device to depths between 4 and 14 inches depending on the machine used. The transport-injector trucks would be able to apply all sludge generated at the facility by making three hauls per day, 20 or 30 days a month for three months.

This is a relatively new system which is used in several places in the United States. The system has several potential problems including:

1. Injection is not feasible when the ground is frozen deeply and adequate soil coverage of the sludge is not achieved. Therefore, alternative disposal or storage methods may be required

during the winter if sludge is removed from the third cells in winter.

2. Depth of injection and timing of applications are critical for repeated use of the site. Both of these affect the ability of the liquid sludge to dry out and be incorporated into the soil. Continuous application may not be feasible or possible.

3. Potential exists for salt build-up in the soil, coliform accumulation in soil, and sporadically high nitrate leaching when crops are not planted.

4. Loading rates, speeds, and depth of sludge injection need to be adjusted for site conditions (e.g., soil type, infiltration rates) as well as for sludge characteristics (e.g., percent solids).

5. Application in bands may lead to localized concentrations of less mobile metals.

These considerations should be addressed in the sludge management plan.

Northglenn's sludge will be injected on active farmland used to raise crops, such as corn and hay, for animal consumption. Injection places sludge in the root zone where it is most beneficial to plants and accessible to microorganisms. Immediate injection eliminates the need for a second machine to follow a spreader to turn sludge under. Injection also eliminates odors, prevents surface runoff and places sludge where it will not be in contact with plants or animals, minimizing health-related concerns. The tilling action of the injection is a benefit to the farmer, reducing his cost and labor. Actual farming operations will be contracted for by the City.

Proposed Sludge Application Sites

While Northglenn has not provided any letters of intent that farmers will be willing to farm with Northglenn sludge, this would not be a difficulty because Northglenn can use City-owned land if farmers are not willing to participate.

The City of Northglenn currently plans to contract with agricultural landowners in Adams County immediately south of the treatment lagoon and reservoir site to receive stabilized sludge for land application. There exists over 1,000 acres of suitable agricultural lands in Adams County within two miles of the lagoons.

If contractual arrangements with agricultural landowners prove difficult, the City has another option available. The City owns four parcels of vacant or agricultural land within or near the City limits. These include the lower Clear Creek Ditch agricultural parcel acquired by the City for water rights, and the Northwest Open Space parcel, the Stonehocker Park parcel, and the vacant parcel southeast of Stonehocker Park, all within the City limits. The total acreage of these four parcels is approximately 290 acres. The current land use in the three parcels within the City is primarily vacant while the Clear Creek Ditch parcel is currently in agriculture.

The future land uses of the three parcels within City limits include recreational and open space uses. However, none of these parcels is scheduled for immediate recreational development. They will therefore be available for agricultural use with sludge applications for the first few years of the project's operation. This will provide the City with ample lead time to contract for the use of additional agricultural lands. Northglenn does not specify who will farm the lands owned by them.

Sludge Utilization Program

Sludge will be used in place of chemical fertilizers to supply nutrients to corn and grass crops. The nitrogen, phosphorus, and potassium available in sewage sludge can be estimated from average values for nutrients found in domestic sludge (Table H-1).

The balance of nitrogen, phosphorus, and potassium is scientifically developoed for commercial fertilizers and to assume the ratios of the elements in sludge approximates this balance based on national averages is not valid. It may be necessary to add phosphorus and/or potassium supplements to achieve the desired ratios.

Application Areas

The beneficial and safe use of sludge depends upon proper selection of an application site. Land use, slope, soil characteristics, and proximity to a stream must be considered in site selection. While the specific sludge application sites to be used by Northglenn are subject to future negotiations with nearby landowners, the suitability of the City's currently owned agricultural and vacant lands in Adams County can be evaluated.

Northglenn has considered the basic soil properties of their owned lands. Criteria considered include slope, surface texture, and depth to seasonal high water table.

Slopes are in a range to allow conventional runoff and erosion control, and equipment operation. Soil texture is rated for adequate nutrient retention and minimal equipment operational problems. The depth to seasonal high water will be greater than the depth of sludge application so pollutants are not solubilized. Additionally, Northglenn should evaluated these soils for the following:

1. infiltration/percolation factors, particularly as related to down-slope groundwater and surface water

2. pollutant solubility, specifically metals and nutrients, and pathogens transport and survivability

3. cation exchange capacity of soil

Northglenn has assigned rating factors for ranges of soil slope, texture, and depth to seasonal high water table. These ratings are presented in Table H-4. This rating of Northglenn-owned land indicates that approximately 115 acres of suitable, 36 acres of moderately suitable, and 44 acres of unsuitable soils are found in the cleared crop areas. Moderately suitable means extra field investigation of soil conditions is necessary and management such as runoff, erosion or groundwater control may be required. Reduced application rates may be used instead of control measures. EPA must require that anywhere there is a potential for a seasonal high water table, sludge should never be applied.

Evaluation of topographic features of Northglenn-owned land (based on USGS topographic maps) Northglenn concludes that no problems are expected with erosion of sludge-amended soil into surface waters.

Application Rate

Generally, annual sludge application rates should be limited by the quantity of nitrogen that can be beneficially utilized by the crops. Nitrogen, in most cases, is the nutrient in sludge available in the highest concentration. Thus, limiting the application rates on the basis of nitrogen will automatically safeguard against salt build-up in soil and accumulation of other nutrients. EPA's analyses indicate that Northglenn's proposed application rate of 5 tons/acre/year is acceptable.

Application Method, Timing, and Crop Management

Sludge will be used to fertilize fields of suitable crops and suitable soils. These fields will remain in corn or hay rotation for the duration of the project or until other agricultural application sites are provided by the City.

Sludge will be hauled and injected in September, October, and November. If severe weather prevents fall application, spring application in May or early June is possible. Crops grown with sludge will be used for silage or grain or both.

The State of Colorado Department of Health has issued Giudelines for Sludge Utilization on Land which addresses issues of sludge stability, sludge quality nutrients and trace elements application, methods of sludge application, soils and site considerations, sludge storage, and monitoring and permit requirements. Northglenn sludge management plan will require certification by the Colorado Department of Health. Certification will be predicated on compliance with all guidelines.

Northglenn's sludge management plan review presents costs for the major capital components including a floating hydraulic dredge, sludge handling tank, and two 5,000 gallon sludge applicator trucks. Capital and operation and maintenance costs are also included. These costs appear to be very low despite the fact that Northglenn plans to rent some of their equipment to other communities. Other costs should be included such as for the equipment expected to be used for sludge

TABLE H-4

RATING FACTORS OF SOIL PHASE PROPERTIES FOR SLUDGE APPLICATION

Soil Property	Rating Factor[a]	Basis of Rating
Slope		
0-3%	S	Runoff
3-8%	S	Runoff, Erosion
8-15%	M	Runoff, Erosion
15-25%	U	High Runoff, Erosion, Equipment Operation
Texture		
Sandy	M(S)[b]	Pollutant Retention
Sandy Loam	M(S)[b]	Pollutant Retention
Loamy Sand	M(S)[b]	Pollutant Retention
Fine Sandy Loam	S	Pollutant Retention
Very Stony Fine Sandy Loam		Damage to Injector
Extremely Stony Fine Sandy Loam	U	Damage to Injector, Pollutant Retention
Silt Loam	S	Pollutant Retention
Muck	U	Application not Possible
Depth to Water Table[c]		
Very Shallow	U	Pollutant Retention, Solubilization
Shallow	M	Pollutant Retention, Solubilization
Moderately Shallow	S	Pollutant Retention
Deep	S	

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a. S - Suitable, M - Moderately Suitable, U - Unsuitable
b. Increased rating if spodic horizon
c. Water table depth can be altered

removal and the sludge holding tank as well as elements discussed in the report such as soil scientists, engineers, and agricultural staff.

MITIGATION MEASURES

The current Northglenn sludge management plan is in substantial compliance with most recent state and Federal guidelines. However, it does not address mitigation measures in the detail deemed necessary by EPA. Therefore, Northglenn will limit sludge application rates as specified until and unless data from the Northglenn treatment facility indicates adjustments may safely be made. In addition, Northglenn will provide a Sludge Management Plan, with annual updates, to the State of Colorado Department of Health minimally specifying:

1. Sludge characteristics

2. Groundwater protection

3. Crop types and farming practices for lands receiving sludge

4. Soils monitoring

APPENDIX I

EVALUATION OF EFFICIENT USE AND CONTROL PLANS

APPENDIX I

EVALUATION OF EFFLUENT USE AND CONTROL PLANS

APPENDIX I

EVALUATION OF EFFLUENT USE AND CONTROL PLANS

The draft EIS presented several mitigating measures for minimizing the potential public health impacts of Northglenn's proposal. These mitigating measures required Northglenn to formulate certain plans and procedures to insure that tailwater would not drain into areas of urban development of the towns of Frederick and Firestone; that an environmental monitoring plan be developed whereby data will be collected to provide a basis for evaluating the possible contaminations of groundwater soils and crops; and that the non-potable municipal irrigation water system of the town of Dacono be replaced or provision made to properly disinfect water withdrawn from the Bull Canal.

TAILWATER CONTROL PLAN

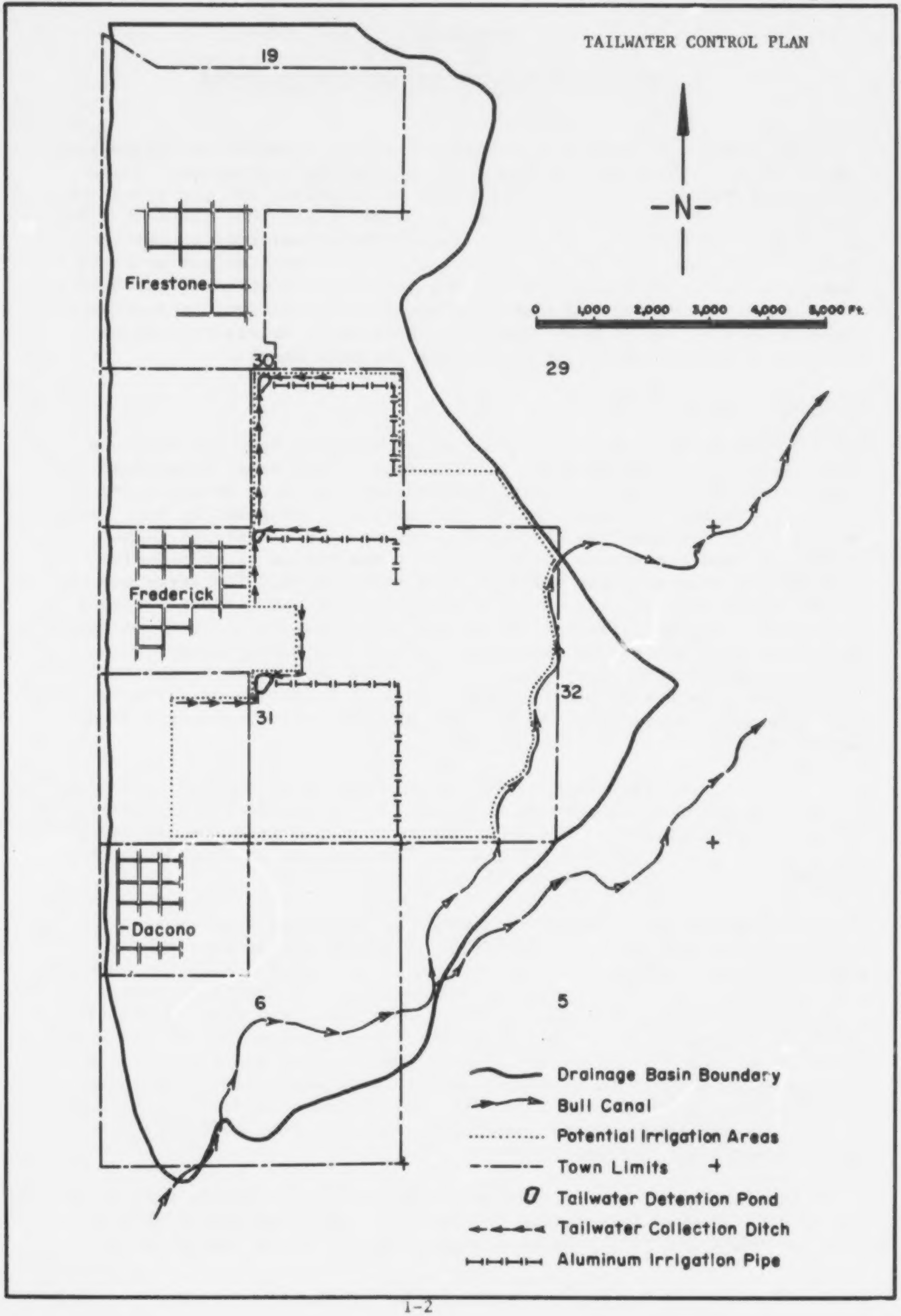
Tailwater is excess irrigation water that has been applied to a field and has not infiltrated into the soil. This water flows down grade until it reaches a natural storage depression or is collected for reuse or erosion control. Tailwater from lands irrigated by Bull Canal waters may drain into the developed portions of the towns of Dacono, Frederick, and Firestone. A field survey and review of 1977 aerial photography indicate that drainage from approximately 880 acres may affect these communities. For the Northglenn project, the irrigation tailwater is to be collected and reused as irrigation water to mitigate potential health problems which might arise from human contact with treated wastewater. Approximately 810 of the 880 acres of potential irrigation area are within the town limits of Frederick or Firestone and may undergo urbanization. If so, the tailwater flow from these areas would cease.

The proposed tailwater control plan consists of collecting excess irrigation water by ditches at the lower end of fields and delivery to a tailwater storage pond. The water is to be pumped from the storage pond back to the fields for reapplication. The proposed collection ditches and storage ponds are shown in Figure I-1.

The amount of tailwater generated and collected depends on the irrigation method used on the field. It should not be more than 20 percent of the irrigation water applied to the field. A higher amount of tailwater may indicate erosive streams in the field, lost fertilizer, and usually results in higher pumping costs for the return system (1). With the exception of the southeast quarter of Section 30 and the west half of Section 32, the water and soil conservation practices of the landowners appear to be excellent and the tailwater flows from these lands appear to be minimal (2). The proposed plan is for improved management in the area through cooperation with the local office of the Soil Conservation Service (SCS).

The tailwater storage ponds are designed in accordance with standard practices used in Colorado by the SCS. Approximately three acre feet of tailwater pond capacity is provided for every 160 acres of

Figure I-1


TAILWATER CONTROL PLAN
-N-
0 1,000 2,000 3,000 4,000 5,000 Ft.
19
Firestone
30
29
Frederick
32
31
Dacono
6
5
Drainage Basin Boundary
Bull Canal
Potential Irrigation Areas
Town Limits
Tailwater Detention Pond
Tailwater Collection Ditch
Aluminum Irrigation Pipe

irrigated area. Automatic pump controls are to be installed and, with the associated design pump capacity, the pond volume is conservative for tailwater flows. The system was not, however, designed for storm water runoff events and the potential exists for the system to be surcharged beyond the design capacity. Proper management can minimize such occurrences by discontinuing irrigation well before a predicted storm occurs. Such management will require close coordination with the landowner, FRICO, and Northglenn.

The effect of urbanization on the tailwater management plan has not been addressed by Northglenn. As the agricultural land is developed, changes in irrigation practices may be necessary as well as other modifications in the tailwater management plan. The tailwater plan raises legal questions of successive reuse of irrigation water. These questions will be resolved in the Water Court and were not considered in this mitigation plan.

REVIEW OF PRELIMINARY FIELD MONITORING PROGRAM

The City of Northglenn has submitted a preliminary field monitoring program for the wastewater irrigation aspects of the Northglenn Water Resources Management Plan. The field monitoring program will involve monitoring groundwater, irrigation tailwater, Bull Canal flows, and plant tissue from irrigated crops. Presented in Table I-1 are the parameters to be measured and frequency of monitoring from each source.

Groundwater Monitoring

Approximately fifty wells will be monitored on a quarterly basis for the constituents presented in Table I-1. The fifty wells will be distributed throughout the irrigated area at a density of approximately one well per quarter section of land. Additional wells located along the fringes of irrigated areas will monitor groundwater flows leaving the irrigated areas. The location of existing wells available to be monitored are illustrated in Figure I-2. The wells will be monitored prior to irrigation with treated effluent to determine baseline conditions.

The proposed monitoring program appears adequate to detect any significant changes in groundwater quality caused by irrigation with treated effluent. The frequency will allow early detection and mitigation of any observed groundwater quality degradation. It would be beneficial to monitor deep wells (tapping lower aquifers) to ensure that wastewater is not seeping to the lower aquifers. The likelihood of this occurring is small.

Bull Canal Overflows and Irrigation Tailwater

The irrigation tailwater will be monitored monthly during the irrigation season for the parameters shown in Table I-1. In addition, the excess irrigation water collected at the terminal reservoir will be monitored periodically. (See Figure I-2) The frequency of monitoring this reservoir is currently not established. It is recommended that the terminal reservoir be monitored monthly during the irrigation season.

TABLE I-1

SUMMARY OF THE FIELD MONITORING PROGRAM

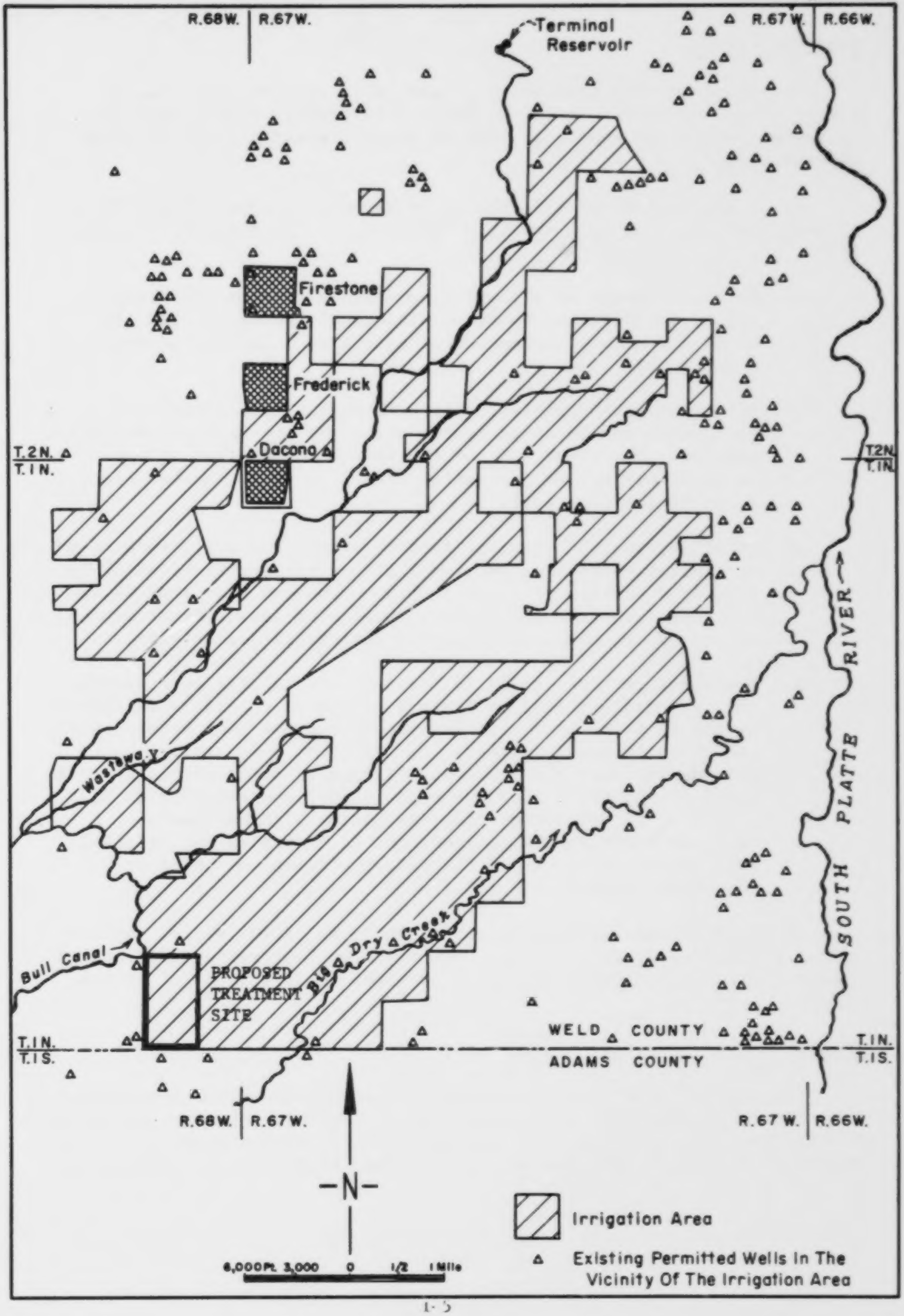
Constituent Measured	Groundwater	Frequency of Sampling Irrigation Tailwater	Crops
Biochemical Oxygen Demand	Q	M	
Chemical Oxygen Demand	Q	M	
Suspended Solids	Q	M	
Nitrogen (Total)	Q	M	A
Nitrogen	Q	M	
Phosphorus (Total)	Q	M	A
Coliform (Total)	Q	M	
Coliform (Fecal)	Q	M	
pH	Q	M	
Total Dissolved Solids	Q	M	
Alkalinity	Q	M	
Barium			A
Cadmium			A
Cobalt			A
Copper			A
Iron			A
Manganese			A
Mercury			A
Nickel			A
Lead			A
Zinc			A
Boron			A
Molybdenum			A

Q = quarterly

M = monthly

A = annually

Figure I-2


R.68W.
R.67W.
Terminal Reservoir
R.67W.
R.66W.
Firestone
Frederick
Dacono
T.2N.
T.1N.
T2N.
T.1N.
Wasteway
Bull Canal
PROPOSED TREATMENT SITE
Big Dry Creek
RIVER
PLATTE
SOUTH
WELD COUNTY
ADAMS COUNTY
T.1N.
T.1S.
T.1N.
T.1S.
R.68W.
R.67W.
R.67W.
R.66W.
-N-
6,000 Ft. 3,000 0 1/2 1 Mile
Irrigation Area
Existing Permitted Wells In The Vicinity Of The Irrigation Area

Crop Monitoring

The proposed crop monitoring program will monitor crop tissues annually for the metals listed in Table I-1. Baseline data will be collected during the summer of 1980 on crops presently grown by FRICO shareholders.

It is the opinion of EPA that soils as well as crop tissues should be monitored for long-term metals accumulation. The reasons for this are:

1. Different parts of a plant accumulate metals at different rates; in addition, other physiological factors within the plant may affect the amount of uptake of a particular metal by a particular plant.

2. Different plant species react differently to various metals. A level that may be toxic to one plant may not affect a different species. Therefore data on the metals composition of one type of plant may not be indicative of the value in another plant grown in the same soil.

3. Other physical or chemical factors within the soil, such as pH or organic matter content, will affect the degree of metal uptake by a particular plant species. Changes over time in one of these factors would cause a greater or lesser metal concentraton in the plant for the same soil metal concentration.

4. For these reasons, soils in the area should also be monitored for the metals listed in Table I-1. Crops should be monitored to see if there is a correlation between the crop metal content and the soil metal content. In addition, some similar soils outside but near the wastewater irrigated soils should be monitored to determine if any change in soil characteristics is caused by factors other than irrigation with wastewater. A baseline study should be conducted to determine the existing soil characteristics and the number of samples needed to adequately monitor the soils.

Although initial monitoring should be on an annual basis, the frequency could be decreased to once very three or four years if no appreciable increase is noticed in the first three to five years of irrigation.

DACONO IRRIGATION SYSTEM

The Town of Dacono has a nonpotable water system which draws water from the Bull Canal and is provided without treatment, for irrigation in certain parts of the town. The degraded quality of the water in the Bull Canal will create an unnecessary health risk within Dacono. Northglenn will resolve this problem either by substituting an alternative water source for Dacono's use in place of the Bull Canal water currently used, or installing and operating a disinfection system on the water Dacono receives from the Bull Canal. If disinfection is chosen, the system will be designed to achieve a level of disinfection acceptable to EPA which shall include a residual chlorine level of not less than 0.3 mg/l.

Northglenn's review of the needs and conditions of the Dacono irrigation system has resulted in the development of plans for a chlorine disinfection system. The cost of this system is approximately $32,500.

Alternatively at Northglenn's expense, a replacement for this system could be provided. Northglenn shall consult with the Town of Dacono to obtain their concurrence with these plans.

APPENDIX J

COST ANALYSIS AND GRANT FUNDING

APPENDIX J

COST ANALYSIS AND GRANT FUNDING

APPENDIX J

ANALYSIS OF COSTS AND GRANT FUNDING

INTRODUCTION

This appendix presents the costs for the various water supply and wastewater treatment alternatives and options, compares their costs and, lastly, determines the EPA grant eligibility and funding amount for the Northglenn proposal.

WATER SUPPLY ALTERNATIVES

The water resource development alternatives which are evaluated in the Northglenn EIS include three water supply source alternatives and two wastewater treatment alternatives. Depending upon which water supply and wastewater treatment alternatives are combined, there are two to five subalternatives which have been evaluated. The alternative water supply alternatives which are evaluated, and associated wastewater treatment options are:

FRICO Water Supply

Three options of exchange agreements available. Northglenn treats wastewater and returns effluent to FRICO.

Purchase of Water Rights. Metro Denver treats wastewater, South Platte discharge.

Windy Gap Water Supply

Northglenn Wastewater Treatment
Metro Denver Wastewater Treatment

Denver Water Board Water Supply

Denver Water Board Raw Water Contract
    Northglenn Wastewater Treatment
    Metro Denver Wastewater Treatment

Denver Water Board Full Service Contract
    Northglenn Wastewater Treatment
    Metro Denver Wastewater Treatment

FRICO Water Supply

This alternative involves obtaining the projected water requirements from the Farmer Reservoir and Irrigation Company (FRICO). There are two possibilities for obtaining FRICO water: enter into an exchange agreement with FRICO, or to purchase water rights from FRICO through condemnation suits.

Exchange Agreement

This option is the proposed Northglenn Land and Water Resources Program. This option requires water supply treatment facilities, replacement water facilities and wastewater treatment facilities. Under this option three possible water supply exchange configurations are identified. Presented in Table J-1 is the water budget for each of the exchange options. These options were described in detail in the draft environmental impact statement.

Water Right Purchases

Northglenn would acquire all water rights needed for its present and future demands by purchase or condemnations from the FRICO Standley Lake Division. For this option the water supply facilities and distribution system requirements would be the same as the facilities used under any of the exchange agreements. Water exchange and associated replacement water are not involved in this option. Under this option wastewater treatment would be handled by Denver Metro. This option is presented as Option 4 in Table J-1.

Windy Gap Water Supply

This alternative involves obtaining transmountian diversion water from the Windy Gap Subdistrict of the Northern Colorado Water Conservancy District. The required unit of water to serve Northglenn's ultimate water needs would have to be purchased from participants in the Windy Gap Project. Delivery of the Windy Gap water would most likely be delivered and stored at Boulder Reservoir and pumped through a new pipeline to Northglenn.

Water treatment and distribution would be the same as the proposed system, and no replacement water would be required.

Wastewater could be treated at either Metro Denver or a Northglenn Wastewater Treatment Plant.

Denver Water Board Water Supply

The Denver Water Board would provide water to Northglenn under a long term contract agreement. Northglenn could contract for either raw water or treated water service.

Raw Water Supply Contract

For this option, raw water would be delivered by the Denver Water Board to Northglenn. Water treatment and distribution would be the same as under the proposed project. No replacement water facilities are required. Treatment of wastewater could be by either Metro Denver or Northglenn, under their proposed wastewater treatment project.

TABLE J-1

NORTHGLENN'S WATER BUDGET
1988 Conditions
(All values in Acre-feet)

	CONDITION							
	Option 1 Without Deep Wells		Option 2 650 af Deep Wells		Option 3 2300 af Deep Wells		Option 4 Return to Metro	
	Dry	Avg	Dry	Avg	Dry	Avg	Dry	Avg
Treated Water Requirements								
Household and Commercial	4140	4140	4140	4140	4140	4140	4140	4140
Irrigation (lawns and parks)	3200	2700	3200	2700	3200	2700	3200	2700
Total Water Required	7340	6840	7340	6840	7340	6840	7340	6840
Raw Water Sources								
Farmers Highline	69	137	69	137	69	137	69	137
Standley Lake Shares	1074	1504	1074	1504	1074	1504	1074	1504
Church Ditch	135	389	135	389	135	389	135	389
Berthoud Pass Ditch	120	608	120	608	120	608	120	608
Arapahoe Well No. 7	5	5	5	5	5	5	5	5
Proposed Deep Wells	0	0	645	645	2295	2295	0	0
FRICO Owned Water	5937	4197	5292	3552	3642	1902	5937(3)	4197(3)
Total Water Supplies	7340	6840	7340	6840	7340	6840	7340	6840
FRICO Exchange								
Net Amount Rec'd from FRICO	5937	4197	5292	3552	3642	1902	0	0
10% Bonus (500 AF min)	594	500	529	500	500	500	0	0
Reservoir Evaporation	316	236	316	236	316	236	0	0
Total Payback Requirement	6847	4933	6137	4288	4458	2638	0	0
Replacement/Wastewater Return								
Sewage - Northglenn	4016	4016	4016	4016	4016	4016	4016	4016
Sewage - Thornton Enclave[1]	885	885	885	885	885	885	885	885
Sewer Line Infiltration	300	300	300	300	300	300	300	300
Storm Runoff-Grange Hall Crk	1200	0	936	0	0	0	0	0
Tributary well Field	446	0	0	0	0	0	0	0
Total Water Available	6847	5201	6137	5201	5201	5201	5201	5201
Excess Physical Supply[2] (Total Available - Payback Requirement)	0	268	0	913	743	2563	To Metro Sewer for Treatment and release to South Platte River	
Diversions to be Augmented							To Metro Sewer for treatment and release to South Platte River	
Grange Hall Creek	1200	0	936	0	0	0		
Tributary Well Field	446	0	0	0	0	0		
Total Augmentation Requirements	1646	0	936	0	0	0		
Augmentation Rights Available	1985	2136	1985	2136	1985	2136		
Excess Water Rights to Meet Flow Requirements	339	2136	1049	2136	1985	2136		

(1) An enclave of Thornton will be connected to the Northglenn system.

(2) Excess water available in the system without augmenting which can be used for irrigation of Northglenn owned FRICO land.

(3) Water obtained from FRICO by purchase or condemnation of additional shares.

Full Contract Services

Under this option, total water service, including maintenance and billing, would be provided by the Denver Water Board. The only capital improvement required for water service would be to Northglenn's distribution system. Replacement water would not be required; therefore, wastewater treatment could be by either Metro Denver or Northglenn.

Major components for the various water supply alternatives are presented in Table J-2.

Development of Costs

This evaluation and comparison of water resource/wastewater treatment options considers capital costs, operations and maintenance costs, and salvage value. Utilizing these costs, present worth and annual household costs were calculated.

Costs for each of the alternatives were prepared following EPA guidelines. The basic assumptions followed for cost forumulation are:

- Construction costs are based on July 1979 prices.
- Operation and maintenance costs are based on January 1, 1980 prices.
- Operation and maintenance costs are based on projected mid period flow rates (1990)
- Present worth calculations are based on a 20-year period and a 6 7/8 percentage rate of interest.
- All systems are sized to serve the ultimate population of the service area (42,500 people).
- All operation and maintenance costs are based on projected 1990 flow rates.
- The present worth and equivalent annual costs are reduced by the salvage value of various system components in the year 2000.
- Calculations of salvage values follow EPA cost effectiveness guidelines.
- An average household cost is based on average year water demands.

Capital Costs

Capital costs are for all major components of each alternative. Major component costs were determined using recent bid prices for related jobs, Dodge and Means construction cost manuals, and consultation with the appropriate engineers and vendors.

TABLE J-2

FEATURES OF WATER SUPPLY/WASTEWATER TREATMENT OPTIONS

	FRICO WATER SUPPLY		WINDY GAP WATER SUPPLY		DENVER WATER BOARD WATER SUPPLY			
					Raw Water Contract		Full Service Contract	
	FRICO Agricultural Reuse	Metro Denver Single Purpose	Northglenn Wastewater Treatment	Metro Denver Wastewater Treatment	Northglenn Wastewater Treatment	Metro Denver Wastewater Treatment	Northglenn Wastewater Treatment	Metro Denver Wastewater Treatment
Water Supply								
Raw Water Source	Clear Creek	Clear Creek	Transmountain	Transmountain	Transmountain	Transmountain	Transmountain	Transmountain
Raw Water Storage	Standley	Standley	Boulder Res.	Boulder Res.	DWB	DWB	DWB	DWB
Raw Water Delivery	Gravity	Gravity	Pumped	Pumped	Gravity	Gravity	Pumped	Pumped
Treatment Plant	Northglenn	Northglenn	Northglenn	Northglenn	Northglenn	Northglenn	DWB	DWB
Distribution System								
New Improvements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thornton Pipes Purchase	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Billing & Maintenance	Northglenn	Northglenn	Northglenn	Northglenn	Northglenn	Northglenn	DWB	DWB
Replacement Water								
System Required	Yes	No	No	No	No	No	No	No
Wastewater Collection								
Thornton Pipes Purchase	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In-City Improvements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interceptor System	Northglenn	Regional	Northglenn	Regional	Northglenn	Regional	Northglenn	Regional
Wastewater Treatment								
Site	Bull Canal	Central Plant	Bull Canal	Central Plant	Bull Canal	Central Plant	Bull Canal	Central Plant
Method	Lagoons	Conventional	Lagoons	Conventional	Lagoons	Conventional	Lagoons	Conventional
Storage	4000 AF	0	3300 AF	0	3300 AF	0	3300 AF	0
Stormwater Management								
System Included	Yes	No	No	No	No	No	No	No

The major components of water treatment, operational storage, and distribution services were sized for a dry year water requirement of 7,340 AF per year. These component costs are assumed to remain constant and independent of any alternative. Cost variation will occur from different raw water source developments.

Operations and Maintenance Costs

Operations and maintenance (O&M) requirements result in an annual cost for the personnel, equipment, supplies and utilities needed to maintain the annual O&M of both water supply and wastewater treatment facilities. Costs have been calculated for the mid-period of operation, 1990. These annual O&M costs are considered to be the average O&M costs throughout the analysis period. From these costs present worth values are calculated by taking this expense as an annual expense for the entire analysis period.

Operations and maintenance costs are formulated by using past billing records when available, O&M cost curves, or by using a percentage of the overall capital costs for the facility.

Salvage Values

To compute localized costs for a comparison of the alternatives, EPA guidelines require salvage values to be calculated for all system components. Salvage values are calculated at the end of the 20-year planning period using 6 7/8 percentage interest rate and straightline depreciation during the service life of the facility. Service lives for facilities are as follows: Land is permanent and is inflated 3 percent per year; structures, 30 to 50 years; process equipment, 15 to 30 years; and auxiliary equipment, 10 to 15 years.

Present Worth Values

Present worth values are calculated by using capital costs, operations and maintenance, and salvage values. Capital cost present worth is the calculated capital cost figure. Operations and maintenance present worth is the present value of the annual O&M costs, taken as if the calculated O&M costs for 1990 flows were the average annual expenditure for the planning period. Salvage value present worth is the present worth of the salvage values that are calculated for the end of the planning period. Project present worth values are capital costs plus operations and maintenance present worths minus salvage value present worths.

Annual Average Household Cost

Annual average household costs are calculated from the annual costs and the projected average household water/wastewater consumption and discharge. Annual cost for each alternative project is the present worth values extended over the planning period, expressed as an annual expenditure. Water consumption costs are calculated based on the annual expenditures and an average year water demand of 6,840 acre feet. Wastewater discharge costs are developed using Northglenn's projected wastewater flow of 4,016 acre feet per year and the expected annual expenditures. The replacement water cost which was calculated for the FRICO Exchange Alternative was based on the amount of replacement water required and the annual expenditure attributed to replacement water development.

To arrive at a cost comparison for the alternatives that will directly be attributable to the consumer, annual average household costs are calculated. Annual average household cost is the consumptive use rate times the annual average household consumptive use or discharge. Average household consumptive use is 131,400 gallons per year for water supply. This figure is based on projections made by Wright-McLaughlin Engineers. The annual average household wastewater discharge is projected to be 81,030 gallons per year or 74 gallons per day per person by Sheafer and Roland. The annual average household quantity of replacement water is the quantity of replacement water required per household to account for the total replacement water quantity for each option under the FRICO exchange.

WATER SUPPLY/WASTEWATER TREATMENT COSTS

This section presents the cost of all system components for each water resource alternative. Water supply costs are presented first then the wastewater options are presented.

FRICO Water Supply

Water supply under this alternative would come from Clear Creek and would be stored in Standley Reservoir.

FRICO Exchange Agreement

Under the FRICO Exchange Agreement there are three possible options available to Northglenn. Each option varies with the amount of water borrowed and returned to FRICO. The supplemental water supply needed for augmentation could be developed from either deep wells in the Arapahoe formation, or a tributary well field along the South Platte River. For each exchange agreement, borrowed water plus a 10 percent bonus will be required for repayment. This repayment will incur a replacement water cost that will require initial capital outlay and a continued operation and maintenance program. To meet the replacement water obligation, Northglenn proposes to treat its own wastewater flow to a sufficient quality for a successive use program. Because of the replacement water obligation, only the wastewater treatment option available is to have Northglenn treat the wastewater. Costs for each system component, water supply and distribution and replacement water are discussed below.

Water Supply - Capital costs for each option vary by the amount of water required and its source. It is realized that any option implemented will affect the quantity of water borrowed from FRICO, but because of operational procedure and diurnal flow variations in water distribution demands, the size of this transmission main is assumed to remain the same. Capital costs for each option are presented in Table J-3.

TABLE J-3

WATER SUPPLY

ITEM	OPTION I (Avg. Year) CAPITAL COSTS	O&M	SALVAGE VALUE	OPTION II (Avg. Year) CAPITAL COSTS	O&M	SALVAGE VALUE	OPTION III (Avg. Year) CAPITAL COSTS	O&M	SALVAGE VALUE
Standley Lake Pipe	1,494,100	67,437	50 yr. 248,527	1,494,100	67,437	248,527	1,494,100	67,437	248,527
Treatment System	4,979,200	418,668	30%-20 yr. 70%-50 yr. 579,765	4,979,200	418,668	579,765	4,979,200	418,668	579,765
Distribution New & Thornton Pipes	20,338,700	280,986	30%-20 yr. 70%-30 yr 1,302,502	20,338,700	280,986	1,302,502	20,338,700	280,986	1,302,502
Deep Well and Well No. 7	140,774	In Standley Lake Pipe O&M	30 yr. 12,879	629,984	Combined w/ Standley Lake	57,616	2,240,860	Combined w/ Standley Lake	205,009
Maintenance Eq.	200,000	0	0	200,000	0	0	200,000	0	0
Const. Maint. & Resident Eng.	1,857,300	0	0	1,857,300	0	0	1,857,300	0	0
Land & Easements	180,000	0	3%/yr. 90,123	180,000	0	3%/yr. 90,123	180,000	0	90,123
Contingencies	375,000	0	50 yr 62,377	375,000	0	50 yr. 62,377	375,000	0	62,377
Eng. Legal & Admin.	1,696,800	0	0	1,696,800	0	0	1,696,800	0	0
Overhead & Admin.	0	299,250	0	0	299,250	0	0	299,250	0
Water Right Purchases	4,110,120		1,087,126	4,110,120		1,087,126	4,110,120		1,087,126
Total	35,371,994	1,066,341	3,383,299	35,861,004	1,066,341	3,428,036	37,472,080	1,066,341	3,575,389

Present Worth

Capital Costs	
Less Thornton Pipes	$ 18,258,694
Thornton pipes	14,518,700
O&M 1,066,341 (10.694644)	11,404,137
Salvage	3,383,299
Total P.W.	$ 40,798,232
Annual P.W. ($/yr)	$ 3,814,828
Unit Cost (6840 AF/yr)	1.71 $/1000 gal
Annual avg. household cost (131,400 gal/yr)	225 $/yr

Present Worth

Capital Costs	
Less Thornton pipes	$ 18,747,704
Thornton pipes	14,518,700
O&M	11,404,137
Salvage	3,428,036
Total P.W.	$ 41,242,505
Annual P.W. ($/yr)	$ 3,856,370
Unit Cost (6840 AF/yr)	1.73 $/1000 gal
Annual avg. household cost (131,400 gal/yr)	227 $/yr

Present Worth

Capital Costs	
Less Thornton pipes	$ 20,358,780
Thornton pipes	14,518,700
O&M	11,404,137
Salvage	3,575,389
Total P.W.	$ 42,706,228
Annual P.W. ($/yr)	$ 3,993,235
Unit Cost (6840 AF/yr)	1.83 $/1000 gal
Annual avg. household cost (131,400 gal/yr)	240 $/yr

Cost up-dated from Northglenn Water Management Program Vol. 2 4/20/77 12%/yr.

Assumptions: Capital costs for the Standley Lake transmission main will not change. Operational procedures dictate that a certain size pipe will be required to accommodate the diurnal flow variation when coupled with reservoir facilities; therefore, it is assumed that the transmission main has been designed on these operating constraints. Annual flow decreases through the Standley transmission line for various options will reduce the O&M, but the increased deep well yield will increase O&M; therefore, total over all O&M costs will not change.

Water right purchase is for the presently-owned water in Standley Lake:

Total Water Rights Costs 9,261,000
Total Water Rights =

$$\frac{9,261,000}{3150} = 2940 \ \$/AF$$

Standley Lake = 1398 (2940) - 4,110,120
Replacement water 1755 (2940 = 5,159,700

Operations and maintenance costs are calculated by updating the costs which appear in the Northglenn Water Management Program, Volumes 1 and 2, prepared by Wright-McLaughlin Engineers. Annual O&M costs for the three options are presented in Table J-3. These O&M costs are for projected 1990 flow rates.

Salvage values were calculated from the capital costs required for each system. Salvage values for the water supply system are presented in Table J-3 for all three exchange agreements. Present worth and annual household costs are also presented in Table J-3.

Replacement Water - Replacement water costs are associated with the wastewater transmission from Northglenn to the treatment facility, treatment at the proposed treatment plant, and storage in the proposed Bull Canal Reservoir. Table J-4 shows borrowed water quantities and replacement water obligations for average years under each option. Capital cost for the replacement water systems of Options I and II has remained about the same because of the unknown flow variations. Cost variations of these two options are a result of the amount of water rights required for augmentation of delivered water. Option III has no replacement water costs because of the large volume of water to be developed from the deep wells and the excess wastewater flow that is originally owned by Northglenn. Table J-5 shows the replacement water capital costs.

Operations and maintenance, salvage value, present worth, and annual average household costs for the replacement water system are presented in Table J-5. These costs have been updated from the Northglenn Water Management Program by Wright-Mclaughlin Engineers.

Water Right Purchases

For this option additional water entitlements would be required from the Standley Reservoir Division of FRICO. There would be no replacement water obligation; therefore, wastewater treatment could be treated at Metro Denver.

Water treatment and distribution capital costs for this option would remain the same. Additional capital outlay would be required for raw water right purchases. Informaton supplied by Sheaffer & Roland indicates that Standley Reservoir shares yield 5 acre feet per share in a dry year and shares are assumed to be priced at $17,500 per share. It was assumed that enough shares would be purchased to ensure water during a dry year. Table J-6 shows the water supply capital costs for this option.

Operations and maintenance costs for this option are developed by the same method as for the exchange agreements. Operational procedure would be similar for all these options. Table J-6 shows O&M for this option for the projected 1990 flow. Salvage values, present worth, and annual average household costs are presented in Table J-6.

TABLE J-4

REPLACEMENT WATER ATTRIBUTED TO NORTHGLENN PROPOSAL

	Average Year			Dry Year		
	Opt. I	Opt. II	Opt. III	Opt. I	Opt. II	Opt. III
1. Total Supply	6,840 AF	6,840 A.F.	6,840 AF	7,340	7,340	7,340
2. Borrow Supply	4,197 AF	3,552 AF	1,902 AF	5,934	5,292	3,642
3. Owned Supply	2,643 AF	3,288 AF	4,938 AF	1,406	2,048	3,698
4. Percent borrowed Line 2 Line 1	61	52	28	81	72	50
5. Percent Owned Line 3 Line 1	39	48	72	19	28	50
6. Borrowed Water to Each House: (Avg.Year; Line 4 x 131, 400 gal/yr)	80,154 gal/yr-house	68,329 gal/yr-house	36,792 gal/yr-house			
7. Owned Water to Each House: (Avg.Year; Line 5 x 131, 400 gal/yr)	51,246 gal/yr-house	63,072 gal/yr-house	94,608 gal/yr-house			
8. Consumptive Use Borrowed Water (Line 6x.38)	30,458 gal/yr-house	25,965 gal/yr-house	13,981 gal/yr-house			
9. Consumptive Use Owned Water (Line 7x.38)	19,473 gal/yr-house	23,967 gal/yr-house	35,951 gal/yr-house			
10. Wastewater Collection Borrowed Water (Line 6 - Line 8)	49,696 gal/yr-house	42,363 gal/yr-house	22,811 gal/yr-house			
11. Wastewater Collection Owned Water (Line 7 - Line 9)	31,773 gal/yr-house	39,105 gal/yr-house	58,657 gal/yr-house			
12. Line Losses Borrowed Water (Line 10 x .03)	1,491 gal/yr-house	1,271 gal/yr-house	684 gal/yr-house			
13. Line Losses Owned Water (Line 11 x .03)	953 gal/yr-house	1,173 gal/yr-house	1,759 gal/yr-house			
14. Treated Water to Bull Canal from Borrowed Water (Line 10 - Line 12)	48,205 gal/yr-house 2,096 AF/yr	41,092 gal/yr-house 1,787 AF/yr	22,127 gal/yr-house 962 AF/yr			
15. Treated Water to Bull Canal from Owned Water (Line 11 - Line 13)	30,820 gal/yr-house	37,932 gal/yr-house	56,898 gal/yr-house			
16. Change in Borrowed Water (Line 6 - Line 14 Based on 3 person per house and 2000 population 42,500	1,389 AF/yr	1,184 AF/yr	638 AF/yr			
		Required Replacement Water				
1. Change in Borrowed Water (Line 16 from above)						
Residential	1,389 AF/yr	1,184 AF/yr	638 AF/yr			
Commercial	300	256	138			
2. Bonus Based on 10% of Total Water Borrow of 500 AF	500	500	500			
3. Evaporation	236	236	236			
Total Replacement Required	2,425 AF/yr	2,176 AF/yr	1,512 AF/yr			
		Available for Replacement				
1. Northglenn Owned Wastewater (Line 15 from above)	1,340 AF/yr	1,649 AF/yr	2,474 AF/yr			
2. Thornton Enclavement	885	885	885			
3. Line Infiltration	300	300	300			
4. Grange Hall Runoff (Required)						
5. Tributary Well Field (Required)						
Total	2,718 AF/yr	3,071 AF/yr	4,014 AF/yr			
Requirements from Grange Hall and Tributary Well Field to irrigate Northglenn lands	Waste flow compensates for replacement required 1,332 AF/Yr	Waste flow compensates for replacement required 687 AF/yr	Waste flow compensates for replacement required 0			

TABLE J-5

REPLACEMENT WATER COSTS

	OPTION I						OPTION II						OPTION III					
	Average Year			Dry Year			Average Year			Dry Year			Average Year			Dry Year		
ITEM	Capital	O&M	Salvage	Capital	O&M	Salvage	Capital	O&M	Salvage	Capital	O&M	Salvage	Capital	O&M	Salvage	Capital	O&M	Salvage
Treatment Lagoons	$ 255,000		42,416	$ 255,000		$ 42,416	$ 255,000	$	$ 42,416	$ 255,000	$	$ 42,416	$ 0	$	$	$ 0	$	$
Bull Canal Reservoir	988,400	13,900	164,410	988,400	13,000	164,410	988,000	13,900	164,410	988,000	13,900	164,410	0			0		
Pump Station A	50,000	5,660	50%-50yr. 4,148	50,000	5,660	4,158	50,000	5,660	4,158	50,000	5,660	4,158	0			0		
Force Main	216,000	2,530	35,929	216,000	2,530	35,929	216,000	2,530	35,929	216,700	2,530	35,929	0			0		
Water Rights[1]	4,032,431		2,018,961	4,983,019		2,494,903	1,872,771		937,661	2,833,360		1,418,609	0			0		
South Platte System	729,000	33,500	121,251	729,000	33,500	121,251	729,000	33,500	121,251		33,500	0	0			0		
Grange Hall Creek	313,600		52,164	313,600		52,164	313,600		52,164	313,600		52,164	0			0		
Stonehocker Res.	138,000		22,955	138,000		22,955	138,000		22,955	138,000		138,000	0			0		
Land & Easements	75,000		37,551	75,000		37,551	75,000		37,551	75,000		75,000	0			0		
Contingincies For Wastewater	151,400		25,184	151,400		25,184	151,400		25,184	151,430		25,184	0			0		
Contingincies For Other Structures	322,000		53,561	322,000		53,561	[3] 322,000		53,561	322,070		53,561	0			0		
Step 3 Engineering	73,500		0	73,500		0	73,500		0	73,500		0	0			0		
Engineering & Legal	1,096,700		0	1,096,700		0	1,096,700		0	1,096,700		0	0			0		
TOTAL	$ 8,441,031	$ 55,590	$ 2,578,540	$9,391,619	$ 55,590	$ 3,054,482	$6,280,971	$55,590	$1,497,240	$ 6,512,560	$ 55,590	$ 2,009,431						

Capital	$ 8,441,031	Capital	$ 9,391,619	Capital	$ 6,280,971	Capital	$ 6,512,560
O&M	594,515	O&M	594,515	O&M	594,515	O&M	594,515
Salvage	(2,578,540)	Salvage	(3,054,482)	Salvage	(1,497,240)	Salvage	(2,009,431)
Total P.W.	$ 6,457,006	Total P.W.	$ 6,931,552	Total P.W.	$ 5,378,246	Total P.W.	$ 5,097,644
Annual Cost	603,761 $/Yr.	Annual Cost	648,142 $/Yr.	Annual Cost	502,891 $/Yr.	Annual Cost	476,654 $/yr.
Unit Cost (1332 AF/yr)	1.39 $/1000 gal.	Unit Cost (1079 AF/yr)	1.84 $/1000 gal.	Unit Cost (687 AF/yr)	2.25 $/1000 gal.	Unit Cost (760 AF/yr)	1.92 $/1000 gal
Cost per house	42.58 $/Yr.	Cost per house	45.66 $/Yr.	Cost per house	35.55 $/Yr	Cost per house	33.56 $/Yr.

OPTION III: No replacement water necessary, which results in zero costs to consumer.

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[1] Water rights are adjusted for whatever augmentation is required. Total water purchase by Northglenn = $ 5,159,700.

TABLE J-6

FRICO WATER RIGHT PURCHASES

Item	Capital $	O&M $/yr	Salvage Values $
Raw Water Purchase	20,779,500		5,496,177
Standley Lake Pipeline	1,494,100	67,437	248,527
Treatment System	4,979,200	418,668	579,765
Distribution	20,338,700	280,986	1,302,502
Maintenance Equipment	200,000	0	0
Construction Maintenance and Resident Engineering	1,857,300	0	0
Land and Easements	180,000	0	90,123
Contingencies	375,000	0	62,377
Engineering, Legal and Administrative	1,696,800	0	0
Former Water Right Purchases	4,110,920	0	1,087,126
Overhead and Administration		299,250	
Total	56,190,720	1,066,341	8,866,598

Present Worth Capital[1]	$ 52,798,020
O&M	11,404,137
Salvage	8,866,592
Total Present Worth	$ 55,335,558
Annual Work	5,174,137 $/Yr
Unit Cost (6,840 AF)	2.32 $/1000 gal.
Annual Average Household Cost	305 $/Yr.

1. Adjustments for Northglenn's purchases of the Thornton watermains have been made for capital cost present work values.

Operations and maintenance costs for this option are developed by the same method as for the exchange agreements. Operational procedure would be similar for all these options. Table J-6 shows O&M for this option for the projected 1990 flow. Salvage values, present worth, and annual average household costs are presented in Table J-6.

Windy Gap Water Supply

Water supply under this alternative would be obtained from the Windy Gap Transmountain Diversion Project. Capital costs for this alternative differ from the previous alternatives by the proposed method of obtaining raw water supplies. Additional capital costs for the raw water supply would involve the purchase in the Windy Gap System, transmission main, pump station, and storage facilities. Water treatment and distribution would be the same as for Northglenn's proposed plan. Wastewater treatment could be at either Metro Denver or Northglenn's proposed plant.

The total water units available in the Windy Gap project are 480 units at 100 acre feet per unit. To ensure adequate water supplies, Northglenn would be required to purchase 75 units for a total water entitlement of 7,500 acre feet. Units in the Windy Gap project are assumed to be purchased at a price, after inflation, comparable to the original selling price. Operating procedures and seasonal flow patterns indicate that Northglenn would most likely want to purchase storage capacity in the Boulder Reservoir. A total storage capacity of 5,295 acre feet would be required. For raw water delivery from the Boulder Reservoir to Northglenn's proposed water treatment plant, a new 15 million gallon per day transmission line and pumping station would be required. Presented in Table J-7 are the total capital costs for the water supply under this alternative.

Operations and maintenance for the water supply system were formulated based on the amount of capital outlay. Northglenn's share for the operation of the Windy Gap project was taken as a pro rata share of the total costs projected by Windy Gap. Raw water pipeline and pumping operation and maintenance costs were taken as 1 percent of the capital costs and a power cost of $0.034 per kilowatt hour. Operations and maintenance costs for Northglenn's seasonal storage are assumed to be 0.5 percent of the capital costs. Presented in Table J-7 are the estimated annual operations and maintenance costs for the Windy Gap water supply alternative. Also presented in Table J-7 are the salvage values, present worth, and average annual household costs.

Denver Water Board Water Supply

For this water supply alternative, Northglenn would contract with the Denver Water Board for water services. Contract services could be for either raw water services or for full water services. For either water service contract wastewater collection and treatment could be handled by Metro Denver or Northglenn's proposed plant.

TABLE J-7

WINDY GAP WATER SUPPLY

Item	Capital $	O&M $/yr	Salvage Values $
Raw Water Pipeline and Pump Station	11,500,000	276,000	1,569,400
Seasonal Storage Reservoir	7,275,300	199,000	
Windy Gap Water	6,231,500	199,000	1,648,200
Treatment System	4,979,200	342,600	501,700
Distribution System	20,339,400	285,200	1,389,000
Maintenance Equipment	200,000	0	0
Construction Manager and Resident Engineer	1,857,300	0	0
Land and Easement	230,000	0	110,100
Contingencies	4,130,100	0	1,239,000
Engineering, Legal and Administrative	4,393,300	245,000	0
Total	61,136,100	1,391,500	6,457,400

Present Worth Capital[1]	$ 58,541,700
O&M 1,391,500	14,881,597
Salvage	(6,457,400)
Total Present Worth	$ 66,965,897
Annual Worth	6,261,629 $/Yr
Unit Cost (6,840 AF)	2.81 $/1000 gal.
Annual Average Household Cost	369 $/Yr.

1. Adjustments for Northglenn's purchases of the Thornton watermains have been made for capital cost present worth values.

Raw Water Supply

Under a raw water contract agreement, Northglenn would receive raw water supply at the Ralston Reservoir. Northglenn could then pump this water to the proposed water treatment plant.

Water treatment and distribution system costs would be the same as for Northglenn's proposed plan. Total capital costs are presented in Table J-8. The additional capital costs that are shown in Table J-8 would be incurred by the construction of the raw water transmission main from Ralston Reservoir to the water treatment site and system development fees. The new raw water transmission main would have a 15 million gallons-per-day capacity and flow by gravity. Seasonal storage and an adequate raw water development program would be assured by system development fees. These fees are based on the number of service connections (Tap Fees). The projected ultimate number of taps and the Denver Water Board charge per tap by size are presented in Table J-9.

Operations and maintenance costs, in addition to the treatment and distribution of the water, would be required for the raw water pipeline, Denver Water Boards service availability charge, and for the consumptive use charge. An O&M of 0.5 percent of the pipeline capital cost is used because pumping is not required. Service availability charges are similar to lifeline charges and are based on the size and quantity of taps. Presented in Table J-10 are the projected annual service availability charges. Consumptive use charges are based on annual water consumption of 6,840 acre feet at a price of $0.3937 per 1,000 gallons.

Full Service Contract

For this option Northglenn would contract with the Denver Water Board for full water service. For this type of service the storage and distribution system would be the only component retained from Northglenn's proposed project. Treated water would be taken at 56th and Washington Street and pumped through a new pipeline to Northglenn's proposed water storage tanks.

Water distribution system capital costs would remain the same as in the proposed project. Additional capital costs would be required for the construction of a new 15 million gallon-per-day transmission main and pump station. The required system development fees are again based on the number of projected taps. Price schedules for the treated water system development fees are higher due to the added expense of treating the raw water supply. Total estimated project costs for water supply under this option are presented in Table J-11. Presented in Table J-12 are the number of taps, by size, and the price schedule for each tap size.

Operations and maintenance cost for service is based largely on the consumptive use of each dwelling. Operations and maintenance cost for the new transmission main and pump station is assumed to be 2 percent of the capital costs for these facilities. This assumption was based on pipeline location being in urbanized area of development, and because portions of the pipeline will be high pressure type pipe. The pump

TABLE J-8

DENVER WATER BOARD RAW WATER CONTRACT

Item	Capital $	O&M $/yr	Salvage Values $
Raw Water Pipeline	7,644,700	51,600	1,213,200
System Development Fees	11,836,400	0	3,130,700
Service Availability	0	310,200	0
Treating System	4,979,200	342,600	501,700
Water Consumption	0	877,600	0
Distribution	20,339,400	285,200	1,389,000
Maintenance Equipment	200,000	0	0
Construction Manager and Resident Engineer	1,857,300	0	0
Land and Easements	230,000	0	110,100
Contingencies	1,903,900	0	151,100
Overhead and Administration	0	245,000	0
Engineering, Legal and Administration	2,843,500	0	0
Total	51,834,400	2,112,200	6,495,000

Present Worth Capital[1]	$ 49,239,700	
O&M	22,589,227	
Salvage	(6,495,800)	
Total Present Worth	$ 65,333,127	
Annual Worth	6,108,957	$/Yr
Unit Cost (6,840 AF)	2.74 $/1000	gal.
Annual Average Household Cost	360	$/Yr.

1. Adjustments for Northglenn's purchases of the Thornton watermains have been made for capital cost present worth values.

TABLE J-9

SYSTEM DEVELOPMENT FEES[1]

Tap Size	Fee $	Taps	Total $
5/8		69	69,000
3/4	1,000	8091	8,091,000
1	1,925	119	229,075
1 1/4	4,150	0	0
1 1/2	5,400	58	313,200
2	10,700	63	674,100
3	27,000	34	918,000
4	53,000	24	1,272,000
6	135,000	2	270,000
Total			11,836,400

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[1] Water tap projection done by Sheaffer & Roland.

TABLE J-10

SERVICE AVAILABILITY

Tap Size	Annual Fee $/yr	Taps	Total $
5/8	26	69	1,794
3/4	35	8091	283,185
1	42	119	4,998
1 1/4	48	0	0
1 1/2	60	58	3,480
2	84	63	5,292
3	150	34	5,100
4	228	24	5,472
6	420	2	840
		Total	310,200

Source: Sheaffer & Roland, Inc.

TABLE J-11

DENVER WATER BOARD TREATED WATER SUPPLY COSTS

Item	Capital $	O&M $/yr	Salvage Values $
Pipeline and Pump Station	6,140,700	299,800	867,300
System Development	25,308,000	0	6,694,000
Distribution System	20,339,400	Combined with Consumption Charge	1,389,000
Contingencies	1,550,700	0	123,000
Engineering, Legal and Administration	1,404,900	0	0
Land and Easements	99,000	0	47,400
Service Availability		418,100	0
Consumption Charge		1,908,400	0
Total	54,842,700	2,626,300	9,120,700

Present Worth Capital[1]	$ 52,248,400
O&M	28,087,343
Salvage	(9,120,700)
Total Present Worth	$ 71,215,043
Annual Worth	6,658,924 $/Yr.
Unit Cost (6,840 AF)	2.99 $/1000 gal.
Annual Average Household Cost	392 $/Yr.

[1] Adjustments for Northglenn's purchases of the Thornton watermains have been made for capital cost present worth values.

TABLE J-12

TREATED WATER SYSTEM DEVELOPMENT FEES[1]

Tap Size	Annual Fee $/yr	Taps	Total $
5/8	2,350	69	162,150
3/4	2,350	8091	19,013,850
1	4,250	119	505,750
1 1/4	8,100	0	0
1 1/2	9,900	58	574,200
2	18,000	63	1,134,000
3	43,000	34	1,462,000
4	84,000	24	2,016,000
6	220,000	2	440,000
Total			25,308,000

1. Source Sheaffer & Roland, Inc.

station and pipeline was designed for 15 mgd, power costs were assumed to be $0.034/kwh. Annual costs for service availability are based on the number of taps and size. Presented in Table J-13 are the projected taps and annual tap fees for the treated water service. Consumption charge for water use is set up as a block rate as shown in Table J-14. Annual costs are dependent on per capita consumption and persons per dwelling. Based on reports by Wright-Mclaughlin, population projections for the City of Northglenn will be 42,500 persons in approximately 14,200 dwellings. This would be about three persons per dwelling for an average water consumption calculation. Wright-Mclaughlin's projected per capita consumptions are: 74 gallons per capita per day (gpcd) Residential, 46 gpcd Residential irrigation, 11 gpcd Commercial irrigation, and 13 gpcd Commercial. Based on these figures, average annual consumptions would be 131,400 gallons per dwelling, or approximately 5,522 AF/yr for residential use. Total commercial use would be approximately 1,300 AF/yr. Presented in Table J-15 are the tap distribution, consumption, and average annual consumptive costs. Operations and maintenance costs, salvage values, present worth, and average annual household cost for the treated water supply options are presented in Table J-11.

WASTEWATER TREATMENT OPTIONS

Northglenn's Proposed Wastewater Treatment Plan

Costs for wastewater collection and treatment under Northglenn's proposed plan has been developed and presented in the Draft Environmental Impact Statement. Table J-16 shows the estimated required costs for Northglenn's proposed project.

Wastewater Treatment of Metro Denver

Costs for wastewater treatment at Metro Denver were also presented in the Draft EIS. These costs are presented in Table J-16.

SUMMARY AND COST COMPARISONS

Evaluation of alternatives is on a comparative basis and comparisons are strictly on costs associated with each alternative. A summary of calculated cost estimates has been formulated in order to assess the alternatives and is presented in Table J-17.

Annual average household prices have been calculated for the proposed project.

The estimated costs of each alternative are summarized in Table J-17. The range of equivalent annual cost per household is from $384/yr to $507/yr.

The analysis provides a basis for cost comparisons under a variety of alternatives. The least costly alternative for water supply and treatment are the options under the proposed exchange project. High operations and maintenance cost for the other alternatives tend to elevate costs more than the proposed plan.

TABLE J-13

SERVICE AVAILABILITY CHARGE

Tap Size	Annual Fee $/yr	Taps	Total $
5/8	42	69	2,898
3/4	42	8091	339,822
1	50	119	5,998
1 1/2	72	58	4,176
2	102	63	6,426
3	180	34	6,120
4	276	24	6,624
6	504	2	1,008
Hydrants[a]	90	500	45,000
			418,000

a. (1970 WME Report = 411, use 500)

Source Sheaffer & Roland, Inc.

TABLE J-14

DENVER WATER BOARD BLOCK RATES FOR TREATED WATER CONSUMPTION

	Monthly Usage Gallons	Consumption Charge Bimonthly Usage Gallons	Rate Per 1,000 Gallons $
First	15,000	30,000	1.25
Next	35,000	70,000	1.11
Next	650,000	1,300,000	0.83
Over	700,000	1,400,000	0.74

TABLE J-15

TAP CHARGES FOR TREATED WATER CONSUMPTION

	Size	Ultimate No. Taps	Annual Charge per Tap $	Total Annual Charge $
Single Family 5/8 x 3/4	5/8x3/4	8033	192.34	1,545,100
Apartments	1	7	443.67	3,100
	1 1/2	13	929.41	12,100
	2	7	1,283.82	9,000
	3	11	1,675.58	18,400
	4	17	4,371.42	74,300
	6	2	12,740.36	25,500
		57	21,444.26	142,400
Commercial	5/8	69	133.75	9,200
	3/4	58	42.50	2,500
	1	106	261.76	27,700
	1 1/2	38	960.39	36,500
	2	37	1,373.46	50,800
	3	13	1,434.88	18,700
	4	7	1,488.00	10,400
		328	5,698.74	155,800
Commercial	1	6	747.10	4,500
	1 1/2	7	1,511.58	10,600
	2	19	1,511.58	28,700
	3	10	2,134.08	21,300
		42	5,904.34	65,100
Total		8640		1,908,400/Yr

TABLE J-16

WASTEWATER TREATMENT

	NORTHGLENN TREATMENT AND RETURN TO FRICO		
ITEM	Capital Costs	O&M	Salvage
Treatment Lagoons	$ 2,643,100	$ 260,800	$ 439,651
Bull Canal Reservoir	4,354,700	86,000	724,357
Pump Sta. "A"	597,800	32,190	49,719
Force Main	1,729,000	14,430	287,600
Collection System	10,151,100	98,160	510,254
Field Monitoring	57,400	35,100	0
Dacono Disinfection	20,000	1,600	0
Tailwater Control	110,200	1,500	Land 72,000
Maintenance Equipment	150,000	0	0
Construction Manager	429,700	0	0
Land & Easements	161,400	0	0
Contingencies	1,082,570	0	180,074
Engineering	2,212,600	0	0
Step 3 Engineering	513,000	0	0
Sub-Total	24,212,600	529,780	2,198,855
EPA Funding	6,948,000	0	0
TOTAL	$ 17,264,600	$ 529,780	$ 2,198,855

PRESENT WORTH

Capital Less Thornton Pipes	$ 8,273,200
Thornton Pipes	7,991,400
Sub-total	16,264,600
O&M (529,780 x 10.694644)	5,665,808
Salvage Value	<2,198,855>
Total P.W.	19,731,553
Annual Worth	1,844,944 $/yr.
Unit Cost 4016 AF/Yr. from Northglenn	1.41 $/1000 gal.
Average Household 74x3x365	114 $/yr.

	METRO DENVER TREATMENT		
Item	Capital	O&M	Salvage
Denver Expansion	$ 662,679	$ 383,389	$ 66,822
So. Platte 15" Interceptor	670,312	21,400	132,973
Henderson Pump Station	866,700		85,966
Henderson Force Main	1,847,376	18,100	366,473
Washington Pump Station	49,819	300	0
Collection (Northglenn) (Thornton)	546,800 8,991,900	97,900	71,594 713,507
Contingencies	900,777	0	Contained within each item's salvage value
Engineering	501,400	0	0
Debt Service Existing		88,800	
TOTAL	$ 15,037,263	$ 661,099	$ 1,437,335

PRESENT WORTH

Capital Less Thornton Pipes	$ 6,045,863
Thornton Pipes	7,991,400
Sub-total	14,037,763
O&M (661,099 x 10.694644)	7,070,218
Salvage Value	(1,437,335)
Total P.W.	19,690,146
Annual Worth	$ 1,839,300 $/Yr.
Unit Cost 4016 AF/Yr. from Northglenn	1.41 $/1000 gal.
Average household 74x3x365	114 $/Yr.

TABLE J-17

COSTS OF ALTERNATIVE NORTHGLENN WATER SUPPLY/WASTEWATER TREATMENT SYSTEMS

	FRICO WATER SUPPLY		WINDY GAP WATER SUPPLY		DENVER WATER BOARD WATER SUPPLY			
					Raw Water Contract		Full Service Contract	
	FRICO Agricultural Reuse (proposed project)	Denver Metro Wastewater Treatment	North-glenn Wastewater Treatment	Denver Metro Wastewater Treatment	North-glenn Wastewater Treatment	Denver Metro Wastewater Treatment	North-glenn Wastewater Treatment	Denver Metro Wastewater Treatment
Capital ($)								
Water Supply	$ 36,268,000	$ 56,190,000	$ 61,136,000	$ 61,136,000	$ 51,834,000	$ 51,834,400	$ 54,843,000	$ 54,843,000
Replacement Water	7,400,000	0	0	0	0	0	0	0
Wastewater	17,272,000	15,037,000	17,272,000	15,037,000	17,272,000	15,037,000	17,272,000	15,037,000
Total	$ 60,940,000	$ 71,227,000	$ 78,408,000	$ 76,173,000	$ 69,106,000	$ 66,871,400	$ 72,115,000	$ 69,880,000
Operation & Maintenance ($/Yr.)								
Water Supply	$ 1,066,000	$ 1,066,000	$ 1,351,500	$ 1,351,500	$ 2,112,200	$ 2,112,200	$ 2,626,000	$ 2,626,000
Replacement Water	55,000	0	0	0	0	0	0	0
Wastewater	529,800	661,000	529,800	661,000	529,800	661,000	529,800	661,000
Total	$ 1,650,800	$ 1,727,000	$ 1,881,300	$ 2,012,500	$ 2,642,000	$ 2,773,200	$ 3,155,800	$ 3,287,000
Present Worth ($)								
Water Supply	$ 40,798,000	$ 52,798,000	$ 66,969,400	$ 66,969,400	$ 65,333,200	$ 65,333,000	$ 71,222,000	$ 71,222,000
Replacement Water	5,900,000	0	0	0	0	0	0	0
Wastewater	19,739,000	19,671,000	19,739,000	19,671,000	19,739,000	19,671,000	19,739,000	19,671,000
Total	$ 66,437,000	$ 72,469,000	$ 86,708,400	$ 86,640,400	$ 85,072,200	$ 85,004,000	$ 90,961,000	$ 90,893,000
Annual Average Household Cost ($/Yr.)								
Water Supply	230	305	369	369	360	360	393	393
Replacement Water	40	0	0	0	0	0	0	0
Wastewater	114	114	114	114	114	114	114	114
Total	384	419	483	483	474	474	507	507

The cost estimates are for comparison purposes only, following EPA guidelines. The annual charges levied against each household would be different from the costs present in Table J-17 for the water supply options. Reasons for these differences include:

- Other revenues such as tap fees and water leasing can actually reduce the system costs prior to ultimate development.
- Financing of future bond expenditures is likely to be around 9 percent for 30 years if current market conditions prevail.
- No provision has been made for the future inflation of construction, and operation and maintenance costs.
- Some of the options considered are institutionally infeasible at this time. For instance, agricultural reuse under the Denver Water Board raw water and treated water options would be difficult under the Board's policy to retain dominion over the wastewater generated from its water supply contracts.
- EPA construction grant money will effectively reduce the total project costs which are incurred by Northglenn, or Metro Denver, and therefore reduce the price to consumers.

Presented in Table J-18 are what the annual charges per average household and for a single family residence are estimated to be for providing water supply and wastewater treatment under the proposed project. The differences result from consumptive use variation. These estimates include provisions for tap fee revenues, inflation through 1990 and short-term water leases.

TABLE J-18

AVERAGE ANNUAL USER CHARGE

Year	All Households[a] $/yr	Single Family Household $/yr
1980	228	272
1981	315	375
1982	340	405
1983	367	437
1984	396	472
1985	428	510
1986	463	551
1987	463	551
1988	463	551
1989	463	551
1990	463	551

[a] Average includes both single family and multi-family dwelling units.

EPA FUNDING ANALYSIS

The remaining material in this appendix presents the details of EPA's cost analysis, applications of EPA's "sum of the costs" rule to determine grant eligiblity. For purposes of this analysis, the most cost effective wastewater treatment option to Northglenn's proposal is treatment at the Denver Metro plant. Hence, this option is used to determine eligibility.

Metro Effluent Limitations

The level of treatment for Denver Metro which will be used in the analysis is based upon the effluent limitations that are given in the National Pollutant Discharge Elimination System (NPDES) permit for Denver Metro as "Future Effluent Limitations." These limits are:

Parameter	30 Consecutive Day Period	7 Consecutive Day Period	Instantaneous
BOD - mg/1	20	30	
Total Suspended Solids-mg/1	20	30	
Fecal Coliforms-Organisms/100 ml	1,000	2,000	
Ammonia Nitrogen-mg/1	1.5	1.5	
Total Residual Chlorine-mg/1	-	-	0.05
Oil and Grease-mg/1	-	-	10
Dissolved Oxygen	-	-	6.4(min)
pH units between 6.0 and 9.0	-	-	-

The NPDES permit effluent limitations were based upon the wasteload allocation which was part of the South Platte River 303(e) Water Quality Management Plan. The wasteload allocation set the effluent requirements at a level necessary to protect water quality in order to maintain the South Platte River's B2, warm water fishery classification.

At present, the Colorado Water Quality Control Commission is in the process of reclassifying all water bodies in Colorado. The South Platte River will be assigned use classifications. Potential use classifications which could be applied to the South Platte River at the Denver Metro Plant include secondary contact recreation, agriculture, warm water aquatic life class 1, warm water aquatic life class 2 and domestic water supply class 2. Effluent limitations for dischargers will be set at a level to protect the uses for which the River will be classified.

Since at this time there is uncertainty as to the use classifications that will be placed upon the South Platte River and therefore the effluent requirements, it was decided by EPA that the effluent limits in the NPDES permit for the Denver Metro facility shall be used in the determination of the necessary level of treatment at Denver Metro. These limitations are taken from the most recent approved wasteload allocation based upon existing classifications.

Operation and Maintenance (O&M) Costs, Denver Metro

EPA Region VIII was instructed by EPA Headquarters to use the prorated costs of Northglenn's share of the O&M costs at Denver Metro.

The present worth of the O&M costs for the 20-year project will be determined using the mid-period year (1990) operation and maintenance expenses as the annual cost. Therefore, the share of the cost that will be attributed to Northglenn shall be 4.45/165 times the present worth of the O&M costs. 4.45 mgd is the 1990 projected flow for the Northglenn facility and 165 mgd is the 1990 projected flow for the Denver Metro facility.

The annual O&M cost was determined using information from the 1980 Denver Metro Budget (1), the "Phase 1 Report, Central Plant Facility Plan" (Denver Metro Facility Plan) (2), and the plan for the proposed Metro Denver Central Plant, Adams Co. Sludge Recycling Facilities. The annual O&M cost for secondary treatment was taken from the 1980 Denver Metro Budget and was prorated and projected to show the cost for treating Denver Metro's flows in 1990. The costs for bond retirement and the costs of the existing solids disposal system were subtracted out.

Expansion and Upgrade at Denver Metro, Capital Cost Breakdown

The Denver Metro Facility Plan concluded that there is sufficient primary treatment capacity to treat flows at Denver Metro until the year 2004. This conclusion had been qualified; additional studies were recommended on the peaking flow conditions for the primary facilities. For the Northglenn cost analysis, it has been assumed that additional primary treatment capacity will not be required, therefore no capital expense will be used for this item.

The facility plan rated the capacity of the existing "secondary facilities" to be at 132 mgd. At this capacity, the facility plan states that the plant could meet the effluent limits of 20 mg/1 BOD_5 and TSS.

The facility plan specified a number of recommendations to bring the flow capacity up to 185 mgd for the design year 2004.

Several of the recommendations represented changes in the Denver Metro plant that related to improvements in the operability of existing facilities and were not related to increasing the flow capacity of the plant. These costs were therefore not included as costs of treating Northglenn's flows at Denver Metro. These items and costs were:

Immediate pilot work and investigations
Cost $350,000

Additional automation of North Complex activated sludge
Cost $150,000

Provide an improved aeration basin dewatering system
Cost $20,000

Install South Complex standby waste sludge pumps
Cost $50,000

Modification of South Complex secondary clarifiers and flow
distribution system
Cost $500,000

Addition of rapid mixing chambers for chlorination system
Cost $100,000

Modification of existing North Complex chlorine contact basin to
reduce short circuiting
Cost $100,000

A group of items in the list of recommended improvements for the Denver Metro plant were determined to be related to an increase of the flow capacity but their costs could not be broken down in order to show the incremental costs for the additional capacity which would be necessary to accomodate the Northglenn flows. These capital costs were therefore split out using a pro rata basis. The Northglenn share was determined to be the ratio of Northglenn's design flow divided by the total flow increase of the upgrade, 4.64 mgd/53 mgd. The items and their total capital costs are given:

Upgrade or replace the aeration system in the North Complex
Cost $2,500,000

Upgrading of the North Complex secondary clarifiers
Cost $2,000,000

Upgrading of the anaerobic digester mixing system to a mechanical
mixing system
Cost $1,500,000

Conversion of the existing anaerobic digestion system to a dual
digestion system
Cost $4,000,000

An item that was listed was the modification of the anaerobic digester gas collection system and increasing the capacity of the waste gas flare system. One half of this cost was attributed to the increase of capacity of the digesters. Therefore, one half of the cost was multiplied by the pro rata ratio 4.64/53. The total cost of this item is $200,000.

The addition of a final effluent reaeration and foam control basin was recommended. This item would be used to handle the total plant flow. The Northglenn cost of this item was therefore taken out as the incremental cost of the Northglenn flow to the total wastewater treatment flow. The total cost of this item is $1,100,000.

The Denver Metro Facility Plan included a cost estimate for upgrading the plant to meet advanced secondary treatment requirements through nitrification, breakpoint chlorination, and dechlorination.

The nitrification process would be performed using two different types of units. In the North Complex of the plant, combined stage nitrification would be done using a modification of the existing aeration basins. Separate nitrification units would be added to the secondary facilities in the South Complex. The capital cost of modifying the North Complex aeration basin to perform both secondary treatment and nitrification is considerably less than the capital cost of the separate stage nitrification that will be added to the South Complex. The incremental cost of the addition of the capacity for Northglenn's flows will be the cost of the addition of 4.64 mgd to the 65 mgd separate stage nitrification units.

The level of treatment that the Denver Metro Facility Plan provided for was less stringent than the level required by the NPDES permit for Denver Metro. Since it can be expected that operation of the proposed breakpoint chlorination system can be performed to attain this higher level of treatment, the Facility Plan costs were considered adequate.

EXPANSION AND UPGRADE AT DENVER METRO

Costs Determined on Pro rata Basis

Upgrade North Complex aeration system	$ 2,500,000
Upgrade North Complex secondary clarifiers	2,000,000
Upgrade anaerobic digester mixing system	1,500,000
Modification of anaerobic digester gas collection system and increase capacity of waste gas flare system	100,000
Conversion of existing anaerobic digestion system to dual digestion system	4,000,000
Total Cost	$10,100,000

Pro Rata Cost

$\frac{4.64 \text{ mgd}}{53 \text{ mgd}}$ (10,100,000) = 884,226

*884,226 x 1.07 = 946,122

946,000

*The factor 1.07 is included to correct the cost estimate for inflation to July 1979.
All costs equipment 20 year life no salvage value.

Costs Determined on Incremental Cost Basis

Reaeration

Cost equation taken from Figure 6-17, "Construction Costs for Municipal Wastewater Treatment Plants 1973-1977" (3).

$C = 2.27 \times 10^5 Q^{0.87}$

Ratio $\frac{C_1}{C_2} \quad \frac{2.27 \times 10^5\ 165^{0.87}}{2.27 \times 10^5\ 169.64^{0.87}} = .9762$

Capital Cost = 1,100,000

.0238 (1,100,000) = 26,224

Salvage Value - Assume 50 year life for basin
Assume basin cost 1/2 capital cost 13,112

Present Worth (PW) salvage (.6)(13,112)(.2645) = 2,081

26,224 - 2,081 = $24,143

24,143 x 1.07 = 25,883 OR $26,000

Nitrification Facility

Cost equation from EPA 1973 Report "Cost Effective Wastewater Treatment Systems" (4)

Equation $C = 210,055 + 59204.6Q$

Ratio $\frac{C_1}{C_2} = \frac{210,055 + 59,204.6\ (65)}{210,055 + 59,204.6\ (69.64)} = 0.9366$

(1 - .9366)=0.0634

Capital Cost = 12,000,000

.0634 (12,000,000) = 760,800

Salvage Value - Assume 50 year life of basins
Assume basins 50% of costs

PW = .6 (760,800)(.5)(.2645) = 60,369
760,800 - 60,369 = 700,431
700,431 x 1.07 = 749,461
or 749,000

Breakpoint Chlorination

Cost equation from EPA 1973 Report "Cost Effective Wastewater Treatment Systems"

Equation $C = 136,587\ Q^{0.52}$

$\frac{C_1}{C_2} = \frac{185^{.52}}{189.64^{.52}} = .9872$

1 - .9872 = .01280
.01280 (700,000) = 8959
No Salvage Value

8,959 x 1.07 = $9,586
or $10,000

Dechlorination

Use same cost equation as for Breakpoint Chlorination

$$\frac{C_1}{C_2} \quad \frac{165^{.52}}{169.64^{.52}} = .9857$$

$1 - .9857 = .01432$

$.01432\ (500,000) = 7,160$

$7,160 \times 1.07 = \underline{7,661}$

or \$8,000

Total Capital Costs Present Worth 1984 Construction Date

Construction Costs (calculation pro-rata basis)	$ 946,000
Reaeration Facility	26,000
Nitrification Facility	749,000
Breakpoint Chlorination	10,000
Dechlorination	8,000
Total	$1,739,000

Adjust to 1980 present worth

1,739,000 (.76647) 1,332,891

Total Costs

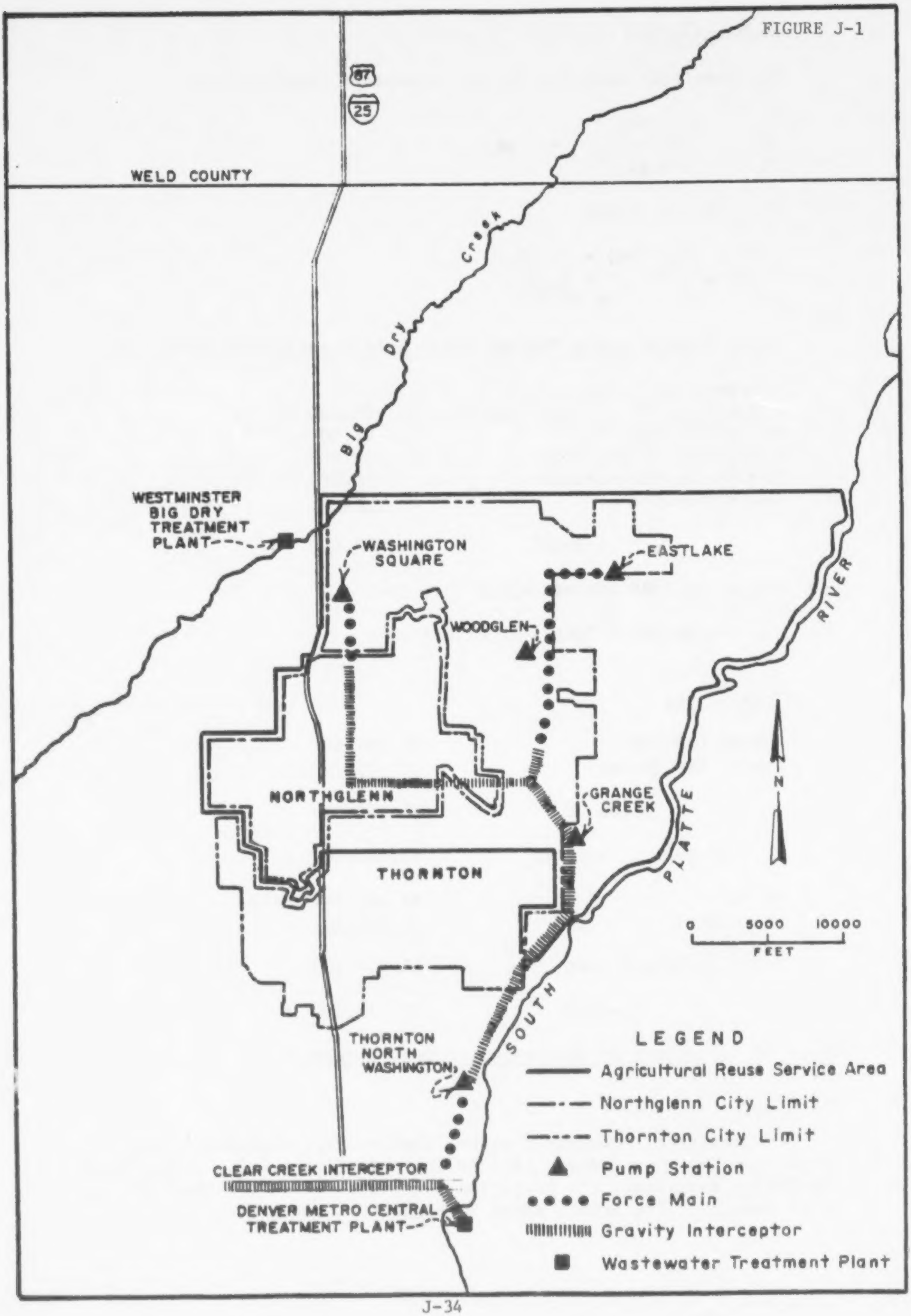
Annual O&M STP	$ 307,689
Annual O&M Sludge	75,700
Total	$ 383,389
PW = 10.6976 x 383,389	$4,101,342
PW O&M	$4,101,342
PW Capital	1,332,891
Total Treatment Cost	$5,434,233
Rounded	$5,434,000

Costs of Conveyance of Wastewater to Denver Metro

Discussion

The existing interceptor system that conveys wastewater from Northglenn and surrounding areas is shown in Figure J-1. Using DRCOG population estimates, the projected wastewater flows for the "Agricultural Reuse Service Area", shown in Figure J-1 are given.

FIGURE J-1


87
25
WELD COUNTY
Big Dry Creek
WESTMINSTER BIG DRY TREATMENT PLANT
WASHINGTON SQUARE
EASTLAKE
WOODGLEN
NORTHGLENN
GRANGE CREEK
THORNTON
N
SOUTH PLATTE RIVER
0
5000
10000
FEET
THORNTON NORTH WASHINGTON
CLEAR CREEK INTERCEPTOR
DENVER METRO CENTRAL TREATMENT PLANT
LEGEND
Agricultural Reuse Service Area
Northglenn City Limit
Thornton City Limit
Pump Station
Force Main
Gravity Interceptor
Wastewater Treatment Plant

	1980	1990	2000
Total flow (million gallons per day)	4.74	6.24	7.00
Flows proposed for treatment with Northglenn System	3.59	4.45	4.65
Flows remaining for treatment at Denver Metro	1.15	1.79	2.35

Using flow estimates for the existing service areas, it has been projected that the Thornton-North Washington pump station would have its capacity exceeded by 1985 (5). It also has been projected that the capacity of the Thornton-North Washington interceptor which extends from 100th Avenue to the Thornton-North Washington pump station will be exceeded by 1985. The Thornton-North Washington force main, which conveys flow from the Thornton-North Washington pump station, is expected to have sufficient capacity until the year 2000. The flows are conveyed from the Thornton-North Washington force main to the Denver Metro sewage treatment through the Clear Creek Inverted Siphon. The Clear Creek Siphon will have to be enlarged during the planning period due to increased flows from the Clear Creek basin regardless of Northglenn's plan.

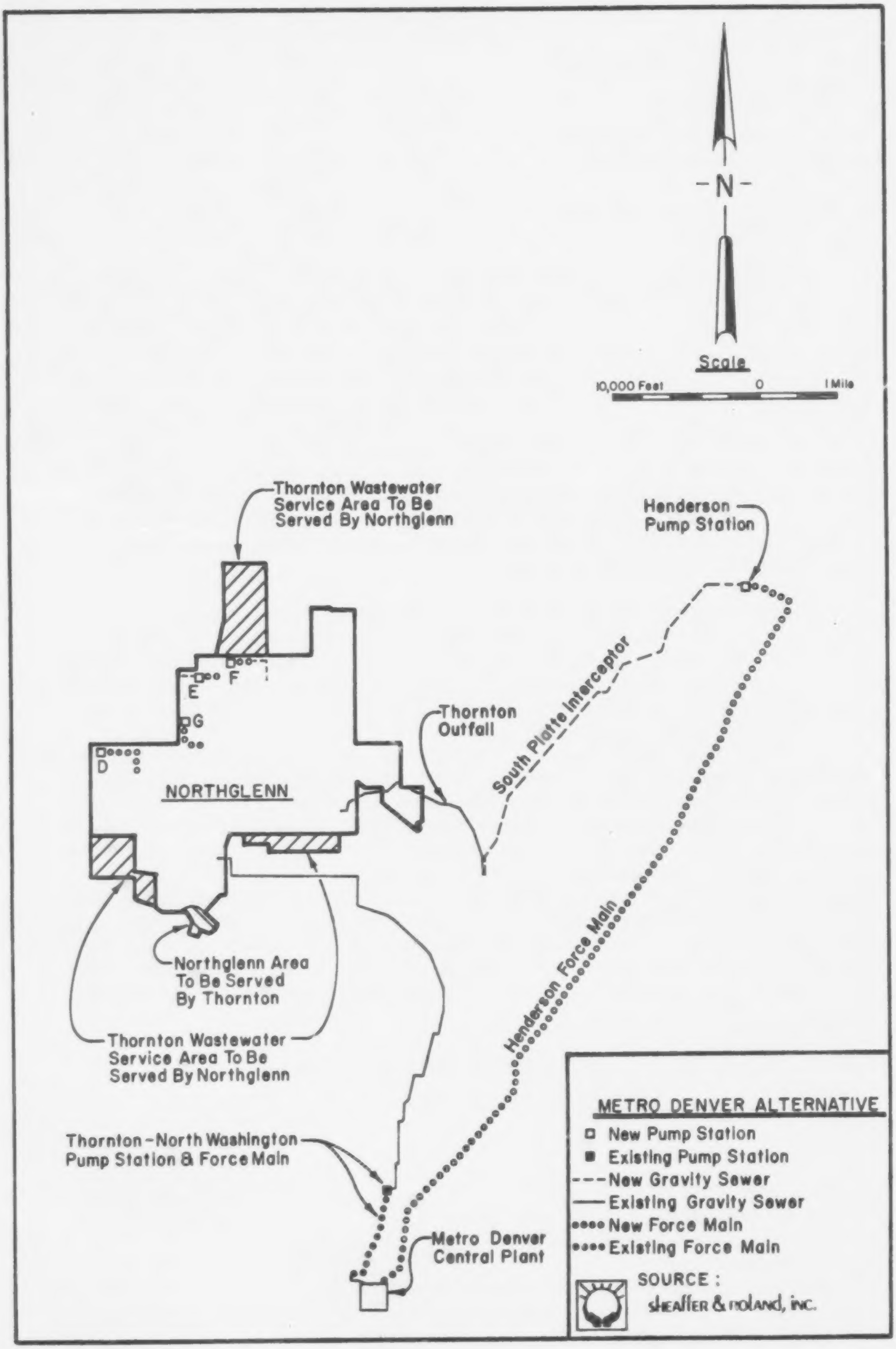
If Northglenn's flows are to be treated at Denver Metro for the planning period, changes would be required in the existing system to handle the projected flow increases. The interceptor system shown in Figure J-2 is the system used in the cost comparison as the facilities which would be necessary for the conveyance of the flows from Northglenn and the surrounding area. Using the system, .90 mgd of Northglenn's flow would be conveyed through the existing Thornton-North Washington Pump Station and Force Main. The remainder of 3.74 mgd of Northglenn's flow would be conveyed using the South Platte Interceptor and the Henderson Pump Station and Force Main. Along with Northglenn's flow, wastewater from parts of Thornton would also be conveyed in the system. These flow quantities are 1.31 mgd in the South Platte Interceptor and 2.36 mgd in the Henderson Pump Station and Force Main. The cost of the construction of the conveyance system which was assigned to Northglenn in the cost analysis is the ratio of the Northglenn flow over the total flow multiplied by the total construction cost. The operation and maintenance costs were also determined on a pro-rata basis using flow quantities.

Wastewater Conveyance Costs Treatment at Denver Metro

South Platte Interceptor 15" gravity sewer

$\frac{3.74\text{ mgd}}{3.74 + 1.31}$ 905,100 (Total Cost)	$ 670,312
Construction Cost	670,312
Contingencies (25%)	167,578
Salvage Value (6) (.2645) 837,890	(132,973)
O&M 17,800 x 10.6976	190,400
Engineering Design & Construction Inspection	83,800
Administration & Overhead 3,600 x 10.6976	38,500
	1,017,617
	or 1,018,000

FIGURE J-2


N
Scale
10,000 Feet
0
1 Mile
Thornton Wastewater Service Area To Be Served By Northglenn
Henderson Pump Station
South Platte Interceptor
Thornton Outfall
E
F
G
D
NORTHGLENN
Northglenn Area To Be Served By Thornton
Thornton Wastewater Service Area To Be Served By Northglenn
Henderson Force Main
Thornton-North Washington Pump Station & Force Main
Metro Denver Central Plant
METRO DENVER ALTERNATIVE
□ New Pump Station
■ Existing Pump Station
---- New Gravity Sewer
—— Existing Gravity Sewer
●●●● New Force Main
●●●● Existing Force Main
SOURCE :
sheaffer & roland, inc.

Henderson Pump Station

Construction 1,413,600 $\left(\frac{3.74}{6.10}\right)$	866,700
Contingencies (25%)	216,675
Salvage Value (Assume 50% of item 50-year life 50% of item 20-year life) (.6)(.5) 1,083,375 (.2645)	-(85,966)
O&M 4,600 x 10.6976	498,500
Engineering & Construction Inspection	108,300
Administration & Overhead 4,600 (10.6926)	49,200
	1,653,409
	or 1,653,000

Henderson 27" Force Main 5,800 LF

Construction 3,013,100 $\frac{3.74}{6.10}$	1,847,376
Contingencies (25%)	461,844
Salvage Value (.6) 2,309,220 (.2645)	-(366,473)
O&M 8,200 (10.6976)	87,700
Engineering 230,900	230,900
Administration & Overhead 9,900 (10,6976)	105,800
	2,367,147
	or 2,367,000

Existing System Costs

North Washington Pump Station O&M	53,500
North Washington Force Main 1981-2000 O&M 300 x 10.6976	3,200
	56,700
	or 57,000
TOTAL	5,095,000

Costs for Northglenn Multiple-Purpose Project

Discussion

The costs for the Northglenn wastewater treatment, agricultural reuse project are given (6). Two items in the cost estimate need to be explained. They are the collection system costs and the land for the contingency plan costs.

Collection System Costs

Northglenn has purchased its wastewater collection system from the City of Thornton. Work is required on sewer system lines in order to sever the Northglenn collection system from the Thornton system. Additional construction is necessary for Northglenn to implement the multi-purpose project; all flows within Northglenn must be conveyed to Pump Station A so they can be pumped to the treatment facility in Weld County.

Two alternative costs were determined for the severance of the Northglenn collection, the cost of severing the system and having flows leave Northglenn at two different drainages to be conveyed to the Denver Metro wastewater treatment plant, and the cost of severing the system with all Northglenn flows being conveyed to Pump Station A. The present worth of each alternative cost consists of the cost of operation and maintenance of the entire collection system as well as the capital cost of the construction necessary to sever the systems.

The cost of the multi-purpose project collection system improvements is then determined as the cost of severance under the alternative where the flows will be conveyed to Denver Metro subtracted from the cost of severance if the flows will be conveyed to Pump Station A.

The work necessary to sever the Northglenn and Thornton collection systems shall not be eligible for EPA funding since presently a wastewater collection system exists and the construction is required due to a transfer of existing facilities between municipalities.

Costs of the Contingency Plan

EPA has required that in order for Northglenn to be given funding as an alternative technology project, the City would have to provide assurance that effluent would be put to agricultural use for the entire project life of 20 years. Northglenn has informed EPA that it has developed a contingency plan. At present, Northglenn owns 1,065 acres which could be irrigated using the Bull Canal system. This land was purchased by Northglenn when the City was obtaining water rights. The acquisition of the land was incidental to the purchase of water. It was determined by Northglenn and EPA concurs, that 1,065 acres would be sufficient to allow all of the treated wastewater from Northglenn to be applied to land. Northglenn has also obtained the right of first refusal from FRICO shareholders so that it can obtain the water rights necessary to implement the contingency plan. Northglenn has agreed to accept a grant condition which would require that they retain a commitment so that if farmers under the exchange agreement would no longer accept FRICO water, Northglenn, through land ownership, lease, or irrigation easement would be able to apply its treated wastewater to land. Under this plan, Northglenn will be able to sell existing land as long as it is replaced by a commitment to an equivalent amount of land.

For the cost effective analysis, it was decided to use the price of the land as a cost of the project. The land purchase will not be eligible for Federal construction grant funding since it is not an integral part of the treatment process and since the purchase was made before a grant was given.

NORTHGLENN MULTI-PURPOSE COSTS

Lagoons & Storage

Earthwork, structures, piping	$ 3,402,200
Asphalt liners & Roads	2,591,800
Landscaping	124,700
Site Buildings	418,500
	6,537,200
Contingencies 10%	653,720
	$ 7,190,920
Salvage Value (50-year life) $\frac{30}{50}$ = .6	
P.W. (salvage value) = 7,190,920 (.6)(.2645)	-1,141,199
	6,049,721
Mechanical Equipment	1,161,300
Electrical Instrumentation, telemetry	488,000
Fencing	54,700
	1,704,000
Contingencies 10%	170,400
	1,874,400
Step 3 Engineering	403,600
Construction Management	342,900
O&M Cost 321,900 (10.6976)	3,443,600
Administration & General Overhead 38,800 (10.6976)	415,000
	12,529,221
Total (Lagoons & Storage)	12,529,000

Land (Northglenn Treatment Plant Site)

Land Cost	179,600
Salvage Value	-(86,000)
	93,600
	94,000

27" Force Main

1980 Construction & Contingencies	2,139,500
1980 - 2000 O&M 7,800 (10.6976)	83,400
Salvage Value (59-year life) (.6) (2,139,500) (.2645)	-(339,539)
Administration & General Overhead 9,160 (10.6976)	98,000
Step 3 Engineering	90,900
Construction Management	77,300
	2,646,839
	2,647,000

Pump Station A

1980 Construction & Contingencies	712,600
1981 - 2000 O&M 34,800 (10.6976)	372,300
Salvage Value 50-year life for 50% of item 20-year life for other 50%	
712,600 (.5) (.6) (.2645)	-(56,545)
Administration & Overhead 3,050 (10.6976)	32,600
Step 3 Engineering	30,300
Construction Management	25,700
	1,116,955
	1,117,000

Field Monitoring Program

1980 Construction & Contingencies	77,500
1981 O&M 35,100 (10.6976)	375,500
	453,000

Dacono Disinfection

1980 Construction & Contingencies	32,500
1981 - 2000 O&M	17,100
	49,600
	50,000

Firestone & Frederick Tailwater Control

Construction & Contingencies	163,700
Salvage Value of Land	-(7,200)
O&M (1,500) (10.6976)	16,046
	172,546
	173,000

Land for Contingency Plan

Cost of Land	221,900
Salvage Value	-(106,300)
Present Worth	115,600
	116,000

Collection System Costs

Multi-Purpose Project	
Construction	1,159,700
10% Contingencies	115,970
Salvage	
Assume 75% 50-year life 25% 20-year life	
.75 (1,275,670) (.6) (.2645)	-(151,836)
O&M 92,700 (10.6976)	991,700
Step 3 Engineering	54,200
Construction Management	46,100
Administration & General Overhead 5,460 (10.6976)	58,400
	2,274,234

Single Purpose Project

Construction	546,800
10% Contingencies	54,680
1981 - 2000 O&M 70,100 (10.6976)	749,900
Salvage	
Assume 75% 50-year life	
25% 20-year life	
Salvage Value .75 (601,500) .2645 (.6)	-(71,594)
Step 3 Engineering	26,400
Construction Management	22,400
Administration & Overhead	27,800
Engineering Design	29,600
	1,385,986

Difference - Multi-purpose/Single Purpose Collection System Costs

	2,274,234
	-1,385,986
	888,248
	888,000
Northglenn - Total Cost	18,067,000

*In accordance with EPA regulations the value of land was appreciated at the compound rate of 3% annually.

SUM OF THE COSTS RULE

In order for EPA to participate in the funding of a multiple-purpose project, it must be shown that the cost of the multiple-purpose project must not exceed the sum of the costs of the most cost-effective single purpose options which accomplish the same purposes.

Sheaffer and Roland has developed costs for a single purpose agricultural water supply project which would deliver water from the South Platte River to a storage reservoir located at the proposed Northglenn wastewater treatment plant site. The project would require the construction of a Platte River diversion structure, a pump station and force main to the reservoir site and a 4,000 acre-foot storage reservoir.

The following present worth cost developed for this alternative:

Capital Costs	11,532,900
Pipeline and storage reservoir salvage value	
Assume 50 year life	-(1,401,900)
Land salvage value	-(47,900)
Operation and Maintenance	1,246,300
	11,329,400

This cost is then added to the costs of the single-purpose wastewater treatment project.

Agricultural water supply	11,327,400
Treatment at Denver Metro	5,095,000
Conveyance to Denver Metro	5,343,000
	21,765,400

This cost is greater than the present-worth cost of the proposed Northglenn multi-purpose project, $18,067,000. Therefore, the Northglenn project complies with the sum of the cost rule.

APPENDIX K

DRAFT INTERGOVERNMENTAL AGREEMENT

INTERGOVERNMENTAL AGREEMENT

THIS INTERGOVERNMENTAL AGREEMENT, made and entered into this ____ day of ___________, 19__, by and between the CITY OF NORTHGLENN, a home rule city of the State of Colorado (hereinafter "Northglenn"), and the COUNTY OF WELD, a home rule county of the State of Colorado acting by and through its Board of County Commissioners (hereinafter "Weld County").

WITNESSETH

WHEREAS, Northglenn has been designated the wastewater management agency for the Northglenn Service Area under the Denver Regional Council of Governments ("DRCOG") Areawide Water Quality Management Plan (208 Plan); and

WHEREAS, Northglenn plans to construct and operate a wastewater treatment facility described as the Bull Canal Reuse Reservoir to serve the Northglenn Service Area, within the unincorporated area of Weld County, and has applied for a grant from the United States Environmental Protection Agency (EPA) to assist it in financing the Bull Canal Reuse Reservoir; and

WHEREAS, Northglenn will deliver treated effluent from the Bull Canal Reuse Reservoir to farmers within Weld County via the Bull Canal for use as irrigation water as part of the Northglenn/FRICO Agriculture Reuse Project; and

WHEREAS, the Larimer-Weld Regional Council of Governments (L-WRCOG) in its Areawide Water Quality Management Plan (208 Plan) has found the Northglenn/FRICO Agricultural Reuse Project "...to be in accordance with the regional goals and objectives and recommends that the project be funded..." subject to specific requirements for the institutional approval of the plan and certain health and environmental concerns addressed herein; and

WHEREAS, Weld County is the designated wastewater management agency for its unincorporated area under the Larimer-Weld Regional Council of Governments Areawide Water Quality Management Plan; and

WHEREAS, Weld County, as the designated wastewater management agency for its unincorporated area, set forth in said Areawide Water Quality Management Plan, has the responsibility for protecting water quality within its management area; and

WHEREAS, both Northglenn and Weld County desire to integrate the Northglenn/FRICO Agricultural Reuse Project into conformity with the Areawide Wastewater Management Plan to minimize the environmental effects from the operation of the treatment facility by insuring that the facility is operated according to the highest standards and in conformance with all applicable operational conditions, and to establish the necessary institutional arrangements set forth in said plan; and

WHEREAS, both Northglenn and Weld County seek to establish an operating relationship based on mutual cooperation; and

WHEREAS, Northglenn and Weld County seek to accomplish these objectives by means of an intergovernmental agreement setting forth the conditions under which Northglenn may operate its wastewater treatment facility in addition to its role as a management agency under the DRCOG Section 208 Water Quality Management Plan.

NOW, THEREFORE, in consideration of the mutual promises, covenants and conditions set forth herein, the parties hereto agree as follows:

1. Responsibilities of Northglenn as a Management and Operating Agency in Weld County. Northglenn and Weld County shall share management agency responsibility for the wastewater treatment facility, hereafter Bull Canal Reuse Reservoir, described in Exhibit A attached hereto and incorporated herein by this reference. Northglenn is hereby designated as an operating agency within Weld County for said facility. The rights and responsibilities of Northglenn as an operating agency are set forth in full below:

(a) Facilities Boundary. The area within Weld County that is included within the Northglenn Facilities Plan boundary for the wastewater treatment system is described in Exhibit B, attached hereto and incorporated herein by this reference.

(b) Facilities Plan. The final facilities plan for the Northglenn treatment facility is described in Exhibit C and attached hereto and incorporated herein by this reference.

(c) Reuse Area. The Northglenn/FRICO Reuse Area is described in Exhibit D attached hereto and incorporated herein by this reference.

(d) Building Permits for the Treatment Facility. Northglenn shall apply for and Weld County shall issue a building permit for the construction of the treatment building at the Northglenn wastewater treatment facility to be located within Weld County. The building permit shall contain the following conditions:

(1) compliance with applicable provisions of the county building code existing at the time of this Agreement.

(2) landscaping treatment of the building and all areas of the site not used as sewage treatment lagoons, reservoir, driveways, parking areas, or cultivated agricultural land.

(3) approval of all accesses onto the treatment facility and to the treatment building by the Weld County Engineering Department, which approval shall not unreasonably be withheld.

(4) compliance with maximum setback requirements defined in Section 3.14 of the Weld County Zoning Resolution, as in effect at the time of this Agreement.

(5) prevention of soil erosion and fugitive dust in excess of emissions permitted under Northglenn's state fugitive dust emission permit.

(6) prevention of the growth of noxious weeds.

(e) Special Use Permit. A permit for the special use of the land and facilities set forth in Exhibit A is hereby granted upon the following terms and conditions:

(1) No open storage, stockpiling or air drying of sludge within the facility boundaries set forth

in Exhibit A without first applying for and securing a permit therefore from Weld County, which permit shall not be unreasonably withheld.

(2) Northglenn shall disinfect the effluent prior to discharge to achieve a criteria of 200 fecal coliform per 100 ml unless the State of Colorado or EPA shall establish a higher limit.

(3) Northglenn agrees to issue and reissue on an annual basis for the design life of the plant, to all shareholders of record in the Standley Lake Division of FRICO, and to all shareholders of record of any other division of FRICO to which waters from the Northglenn reservoir are diverted, an advisory concerning the constituents of the wastewater in the reservoir and a notice that such water should not be used for the irrigation of raw edible vegetable crops. In the event that raw edible vegetable crops irrigated with Northglenn wastewater are offered for sale or public distribution, Northglenn agrees to find alternative process markets for the crops or to acquire at its own expense the crop itself. In lieu of the foregoing, Northglenn, at its option may treat the fecal coliform component of its effluent to a level found by EPA to adequately protect the public health for use in irrigation of raw vegetables, or otherwise so handle or treat the effluent or raw edible vegetables so as to prevent a public health hazard; such as by treatment, posting the use of the vegetables only after boiling, or such other manner acceptable to EPA.

(4) Northglenn shall provide Weld County with an agricultural reuse manual governing the reuse arrangement between Northglenn and the FRICO farmers. Northglenn will develop the Agricultural Reuse Manual (as outlined below) to provide advice to farmers of the Standley

Lake Division of FRICO on the use of treated sewage effluent for crop irrigation. Periodic public reporting in the advisory notices will be provided to the FRICO Board and to anyone requesting this information.

- A. Water Yield Projections
  - 1. Snow survey
  - 2. Standley Lake Yield
    - a. Bull Canal Shares
    - b. Reuse Water
- B. Water Delivery Projections
  - 1. Crop Projections
    - a. Type
    - b. Acres
  - 2. Standley Lake
    - a. Cities
    - b. FRICO delivery
  - 3. Bull Canal Reservoir
    - a. Wastewater
    - b. Makeup Water
- C. Nutrient Delivery Projections
  - 1. Bull Canal Reservoir Qualities by Month
  - 2. Recommended Commercial Fertilizer Application Rates
  - 3. Crop Advisories
- D. Adjustments to Delivery Projections
  - 1. Standley Lake Quantity and Quality
  - 2. Bull Reservoir Quantity and Quality
  - 3. Crop Advisories
  - 4. Field Monitoring Results
- E. Distribution of Reports
  - 1. Agricultural Advisory Reports
  - 2. Water Quality Monitoring Reports

(5) Northglenn will undertake the cost of modifications, operation and maintenance for the Dacono nonpotable water supply to insure that the nonpotable water supply for the Town of Dacono is properly disinfected to protect public health for the design life of the Northglenn project. Northglenn shall cause the disinfection of the existing Town of Dacono nonpotable water supply coming from the Bull Canal at times when the Bull Canal Reuse Reservoir is in operation to maintain a fecal coliform level no greater than the level existing immediately upstream of the Northglenn treatment facility, or, at Northglenn's option, it may instead replace Dacono's existing nonpotable water supply with an equivalent source of supply in exchange for Dacono's FRICO/Standley Lake Division water shares. Northglenn shall consult with the Town of Dacono and secure its approval as

a condition prerequisite to the implementation of any one or more of these plans.

(6) Northglenn will provide physical measures to prevent the flow of wastewater from adjacent agricultural land into the Towns of Frederick and Firestone or any other residential area. Consultation with Frederick and Firestone on the design and location of these facilities is necessary. Operation of these facilities shall be at the request of Frederick or Firestone and Northglenn shall assume no liability thereby to any person claiming a right to the use of said water.

(7) A monitoring program will be developed by Northglenn to include locations and depths of groundwater monitoring wells, locations of surface water monitoring, and procedures for monitoring crops. Pollutant parameters and monitoring frequencies must be developed. Domestic groundwater supplies in the area that could be affected by the project must be identified and periodically monitored. The monitoring program shall be modified as information is developed on items such as the potential for crop contamination by toxic substances.

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(h) of the Clean Water Act. Northglenn will be required to retain all records and information resulting from the monitoring activities including all records of analysis performed and calibration and maintenance of instrumentation for the design life of the project.

Northglenn must provide annual public reporting on the findings of the monitoring program. Northglenn must also identify any nonconformance with regulations concerning the level of contaminants in crops set by the Federal Drug Administration (FDA) or United States Department of Agriculture (USDA), State agriculture and health departments and other government agencies.

EPA will provide L-WRCOG and Weld County copies of the draft program for their review. A minimum of a 90-day review period will be given. EPA will review the L-WRCOG and Weld County comments before the monitoring program is approved.

(8) Northglenn agrees to pay to Weld County a sum equal to twenty percent (20%) of the annual salary of a Weld County Health Department employee for independent processing of monitoring samples. Such payment shall continue prorata from month to month so long as an employee is assigned by Weld County to monitor the reports.

(9) Upon the conveyance to the City of the water rights and diversion facilities, Northglenn agrees to replace, at its own expense with an equal quantity of water in rate and duration of flow, any existing residential groundwater supply that becomes contaminated in excess of applicable state standards as a result of the operation of the Northglenn treatment facility.

(10) Northglenn agrees to take immediate action to respond to any reasonable request made by Weld County to remedy any adverse environmental effect resulting from the operation of the Northglenn facility. In the event of any emergency that poses an imminent threat to public health or safety, Northglenn will immediately contact the Weld County Health Department. Northglenn agrees not to allow the release of any effluent from the treatment facilities boundaries that would threaten the public health or safety.

(11) Northglenn shall assure that sufficient land, approximately 1,100 acres, in the FRICO system is under their control -- through ownership, lease, or contract — for the purposes of effluent disposal. This condition is binding for the 20-year design life of the project.

Weld County shall not prevent the use of such land for that purpose by purchase, agreement or any other governmental action.

(12) In order to insure proper construction of the Bull Canal Reuse Reservoir, Northglenn agrees that during construction of the cut-off key for the reservoir dike, a trench will be made along the northwest boundary that will penetrate down to a competent zone in the Arapahoe formation. An examination of the exposed units will be made to determine if any fault traces cut across this portion of the reservoir. If a fault trace is located within the proposed reservoir area, either the dam will be relocated to exclude the trace, or the trace will be sealed with an impermeable liner before implacement of the clay liner. The results of these investigations and any mitigative measures must be inspected and approved by the Corps of Engineers, who will report the results to EPA.

All shallow test holes within the reservoir site that have a depth greater than 30 feet below the pond base must be plugged with concrete. Any test holes that have a depth of less than 30 feet must be back filled and compacted. The cased USGS test wells (BW-77-15B and BW-77-17B) must be pressure plugged with concrete from the bottom up to insure proper abandonment. EPA will be notified when the plugging is to take place so that a staff member can observe the plugging operation.

The thickness of the clay liner will be increased over the proposed 6" compacted seal for areas where the seal will be in direct contact with sand or sandstone. Clean claystone material must be used. In all cases the inplace claystone that will be used for a seal must be ripped up to the required depth before compacting the six inch thick seal. In areas where claystone is not present, a supply of claystone (from stockpile) must be spread in the area and a compacted seal of at least one foot thick provided.

(13) Northglenn will develop a detailed operations manual for the Bull Canal Reuse Reservoir facility. Weld County Health Department will be provided an opportunity to assist in the development of the manual.

(14) The Bull Canal Reuse Reservoir facility will be monitored by fully trained personnel on a 24-hour per day basis.

(f) Northglenn shall enforce and comply with the terms and conditions of the L-WRCOG 208 plan.

2. Rights of Northglenn as Management and Operations Agency.

(a) Northglenn shall be the sole entity to receive and manage federal or state grant funds for the construciton of the treatment facility.

(b) Northglenn shall have the exclusive right, subject only to the express provisions of this Agreement, to construct, operate, and manage the treatment facility.

(c) Weld County hereby delegates to Northglenn, as operating agency, any right or claim it might have as management agency under the L-WRCOG Section 208 Water Quality Management Plan to perform any of the above functions relative to the Northglenn treatment facility and Weld County hereby agrees to share with Northglenn the rights and responsibilities as a wastewater managem agency pursuant to the L-WRCOG 208 Plan for the Bull Canal Reuse Reservoir facility set forth on Exhibit A.

(d) Weld County agrees to cooperate with Northglenn now and in the future to secure all necessary permits, approvals, grant awards and cooperate in any other manner to ensure the successful and healthful operation of the Northglenn/FRICO Agricultural Reuse Project.

(e) All permits, approvals or similar conditions of local, state, or federal government agencies shall be applied for by Northglenn and secured by Northglenn in its own name and on its own behalf.

(f) Weld County shall retain all land use and zoning authority in the area surrounding the Bull Canal Reuse Reservoir facility set forth on Exhibit A.

(g) Northglenn shall retain all authority for the expansion of the Bull Canal Reuse Reservoir and to approve or disapprove all tap connections into the project interceptors located outside of Weld County. Northglenn shall retain all control necessary for expansion, alteration, or modification of the Bull Canal Reuse Reservoir.

(h) The City of Northglenn and Weld County shall share responsibilities as Management Agencies under their respective 208 Water Quality Plans as to the construction of additional interceptors to the facility from within Weld County to ensure adequate planning, grant award and operation thereof.

3. Dismissal of Pending Litigation. Weld County agrees to dismiss with prejudice its participation in the following lawsuits: (a) Board of County Commissioners of Weld County v. City of Northglenn (79CV431) and (b) Consolidated Ditches Co. v. Water Quality Control Commission (79CV530). In addition Weld County agrees not to prosecute any further action arising out of the construction or operation of the Northglenn/FRICO Agricultural Reuse Project except as may be necessary for the enforcement of this Agreement.

4. Taxes. Northglenn agrees to pay to Weld County each year, a sum of money equal to and in lieu of the real property taxes which would have otherwise been lawfully assessed by Weld County against the real property owned by Northglenn in Weld County, as such property presently exists in both extent and condition of improvement.

5. Titles. The titles to each paragraph herein are illustrati only and shall not be interpreted in such a manner as to alter the meaning of an individual paragraph or the agreement.

6. Severability. Each provision of this agreement is integrated with all other provisions of this Agreement and shall remain in force and effect unless an individual paragraph may be determined to be invalid. If any provision of this agreement shall be deemed to be invalid the entire agreement is null and void.

7. Venue and Interpretation. This agreement shall be binding upon the parties hereto and their successors and assigns. Enforcement of the terms hereof shall be an impartial venue in the Denver District Court. This Agreement is entered into and shall be interpreted pursuant to the provisions of Article XIV Section 18 of the Constitution of Colorado and C.R.S. 1973, Section 29-1-203.

IN WITNESS WHEREOF the undersigned set forth their hand and seals on the day and date above first written.

ATTEST: CITY OF NORTHGLENN

Clerk
Mayor, City of Northglenn

APPROVED AS TO FORM:

City Manager, City of Northglenn

City Attorney, City of Northglenn

Special Counsel

ATTEST: COUNTY OF WELD

Clerk
Chairman, Board of County Commissioners

APPROVED AS TO FORM:

County Manager, County of Weld

County Attorney, County of Weld

Chairman, Larimer-Weld
Regional Council of Governments

APPENDIX L

DRAFT NPDES PERMIT

Colorado Department of Health

4210 East 11th Avenue
Denver, Colorado 80220
Phone (303) 320-8333

Frank A. Traylor, Jr., M.D.
Executive Director

June 4, 1980

CERTIFIED: P06 6984983

RICHARD P. LUNDAHL
10701 MELODY DRIVE, SUITE 313
NORTHGLENN, CO 80234

CITY OF NORTHGLENN

RE: Final Permit, NPDES Permit Number: CO-0036757, WELD COUNTY

Gentlemen:

Enclosed please find a copy of the permit issued under the Federal Clean Water Act and Colorado Water Quality Control Act.

Issuance of this permit constitutes a final determination by the Division of Administration of the Colorado Department of Health, in conjunction with the U.S. Environmental Protection Agency and may be subject to administrative review proceedings pursuant to the State Administrative Procedure Act, including an adjudicatory hearing. You are advised to consult this act and particularly to consult Sections 24-4-104, 24-4-105, 24-4-102(7), and 25-8-401, C.R.S. 1973 for more information. In addition, the Regulations for the State Discharge Permit System contains material that is pertinent to any administrative review of the issuance of this permit.

Your NPDES Waste Discharge Permit required that specific action be performed at designated times. Failure to meet these requirements constitutes a violation of this permit and can result in civil and/or criminal action(s). Please read the permit very thoroughly.

1. All municipal and industrial facilities are required to submit self-monitoring information. (PART I.B. Monitoring and Reporting). Frequencies and types of self-monitoring are summarized in PART I.A. Effluent Limitations and Monitoring Requirements.

2. Monitoring and reporting requirements for feedlots are described in PART I.A. Effluent Limitations and Monitoring Requirements (see 2.c.) and in PART I.B. Monitoring and Reporting.

3. In some instances a schedule of compliance is to be submitted if required by your permit. Please note the required date as specified in PART I of the permit.

4. PART II A. Management Requirements and B. Responsibilities, contains information that explains further requirements which are enforceable as are all other provisions of the permit.

5 PART III Other Requirements specify certain reports that are required and/or notifications that are necessary.

If you have any questions, please contact the Permits Section, Water Quality Control Division at (303)+320-8333, Ext. 3361.

Very truly yours,

Arden Wallum

Arden Wallum
Acting Chief
Permits Section
Water Quality Control Division

AW/ as

cc: EPA
District Engineer - Sam Cooper
Health Department
208 Planning Area

Enclosure

COLORADO DEPARTMENT OF HEALTH
Water Quality Control Division
4210 East 11th Avenue
Denver, Colorado 80220

STATEMENT OF BASIS
CITY OF NORTHGLENN
PERMIT NUMBER: CO-0036757
WELD COUNTY

TYPE OF FACILITY: Major Municipal

S.I.C. NO.: 4952

LOCATION: West ½ of Section 36, Township 1 North, Range 68 West of the 6th Principal Merdian, just north of the Adams/Weld County Line.

CONTACT:
Richard P. Lundahl
10701 Melody Drive, Suite 313
Northglenn, CO 80234
(303)+451-8326

RECEIVING WATER: Bull Canal
CLASS: Unclassified
Effluent Limited Segment

FACILITY DESCRIPTION: The proposed Northglenn facility will treat sewage and stormwater runoff in an aerated lagoon system with discharge to the Bull Canal. The facility will consist of: two parallel sets of three-cell aerated lagoons; a storage reservoir with a capacity of 4362 acre-feet; chlorination in the effluent channel; a pump station and wetwell; a service building for aeration equipment, laboratory, maintenance garage; public seminar room, and offices; and a power substation.

Wastewater from Northglenn will be collected at a pumping station in southeastern Northglenn and transported by force main to the treatment facility. The incoming flow will be measured before entering the first cell, which will be a complete-mix basin. The second and third cells in each set of lagoons will be facultative aerated treatment lagoons. Total lagoon acreage will be 13.5 acres with a 6.55 mgd capacity per each set of lagoons.

From the final lagoons, water will flow by gravity into the storage reservoir. The purpose of this reservoir is to regulate the flow discharged to the canal for irrigation. Mixing equipment will be installed in the reservoir to prevent stratification which could lead to ordor problems during turnover periods. Hydraulics will allow the flexibility to also store Bull Canal water in the reservoir. A pumping station located in the northwestern portion of reservoir will pump water to a discharge conduit to the Bull Canal. This conduit will have chlorination equipment for disinfection of the water as it flows to the canal.

Steps will be taken during construction of the facility to minimize seepage. The bottom of the lagoons will be lined with clay and the inner side slopes will be protected with an asphalt face. The outer slopes of the lagoons will be planted with native grasses. Seepage from the reservoir will be minimized by the impermeable bedrock that underlies the reservoir. The bottom of the reservoir will have a clay liner. The inner side slopes will be protected with asphaltic concrete while the outer side slopes will be planted with native grasses. The asphaltic liner will be backed by a drainage system which will return leakage to the reservoir. An embankment cutoff trench will also be constructed to intercept seepage for return back to the reservoir.

A system of groundwater monitoring wells will also be installed. These wells will be used to monitor any seepage from the facility.

RATIONALE FOR PERMIT LIMITATIONS AND CONDITIONS:

This project has become very controversial during its development with many of its overall aspects complicating the drafting of this permit. Northglenn is seeking an Environmental Protection Agency construction grant for the partial funding of the project and because of this federal participation and the complexity of the situation, an Environmental Impact Statement (EIS) process is being prepared. Opponents have argued the project should not be grant fundable because of doubt as to whether the project is needed from a pollution abatement standpoint (Northglenn's sewage is presently treated by the Denver Metropolitan Sewage Disposal District). Proponents have argued the project is unique because it formally sets out a multiple water use.

Another complicating factor is that the Northglenn treatment facility is to be sited in Weld County and the Larimer/Weld Regional Council of Governments (the City of Northglenn is in Adams County and the Denver Regional Council of Governments) and therefore, conflicts of jurisdiction have developed. Additionally, a water rights issue has been raised because wastewater for Northglenn, which is presently treated and discharged to the South Platte River would be, as the project is proposed, discharged for irrigational purposes in the Bull Canal system. Irrigators of the South Platte system have argued their rights will be damaged by the project.

The Water Quality Control Division has been aware of all these complex issues; however, it has had to proceed under the assumption that the project will become a reality and has strived to act responsible in processing the permit in a timely manner (as required by Colorado Law). All of the complicating factors of this project have contributed to this Division spending more time and effort in drafting this permit than normally would be expended for a permit for a discharge to an irrigation ditch. This permit also has incorporated some requirements which are normally not written into the permit.

An application for a NPDES permit was submitted on May 7, 1979. On September 10, 1979, a draft permit was sent to public notice for comments. The permit was drafted for a discharge to the Bull Canal, a presently unclassified irrigation canal. Because of the interest expressed about the draft permit and the controversial nature of the project, the Division held a meeting in Denver on October 10, 1979 to receive additional public input. Most of the comments during the meeting dealt with the public health aspects of the project.

During the subsequent months EPA reopened the environmental assessment for the project and, in fact, issued on January 4, 1980 a notice of intent to prepare an EIS. The Division has been in close contact with EPA during the preparation of the EIS so that issues associated with the issuance of the NPDES permit could be defined.

Public health issues defined in the draft EIS are:

1. potential health risk from direct human contact with treated wastewater which has received little or no dilution;

2. potential health risk from human consumption of raw edible crops irrigated with the treated wastewaters;

3. unsuitability of the Bull Canal as a water supply as a result of treated wastewater discharge.

Each of these issues raise valid concerns. With the first issue, there is concern of children using the Bull Canal for recreational purposes or coming in contact with tail water from land irrigated with Bull Canal water. The tailwater presently flows unimpeded through the Town of Fredrick. Regarding the second issue, there is the potential for unrestricted use of the Bull Canal for agricultural use. The Town of Dacono has a nonpotable water system which uses water from the canal for irrigation of private gardens. Also, the possibility exists that members of Farmers Reservoir and Irrigation Company (FRICO) may use the canal water to irrigate raw edible crops. The third issue concerns the degradation of the Bull Canal for use as a raw water supply for the Town of Frederick and Ft. Lupton because of the anticipated elevated nitrate levels from the discharge. A more detailed discussion of these issues can be found in the EIS.

In order to mitigate these concerns, EPA has proposed as grant conditions that Northglenn:

1. disinfect their discharge to 200 fecal coliform organisms per 100 milliliters;

2. either provide adequate disinfection of the Dacono nonpotable water system or provide an alternate water supply;

3. provide control facilities to prevent tailwater from flowing into populated areas.

The fecal coliform disinfection proposal has generated much concern in that the Division's draft permit required disinfection to a level of 1,000 organisms per 100 milliliters. The rationale for this limit is based on the recognized standard recommended in the "Water Quality Criteria 1972" by the National Academy of Sciences, and is even more restrictive than the recommended standard for secondary contact recreation classification.

The NAS standard is for unrestricted irrigation use and though not a recently established standard, there has not been any conclusive evidence since to suggest this widely accepted standard is no longer valid. Nevertheless, in response to public concern, this Division requested the Disease Control And Epidemiology Division of the Colorado Department of Health to review this standard and all related research on this topic as it pertained to the Northglenn project. It was the conclusion by the professional staff that the proposed limit would protect the existing use of the Bull Canal.

Subsequent to a public meeting held in Frederick by the Division on April 23, 1980, the City of Northglenn has requested that the Division substitute a permit limitation of 200 organisms per 100 milliliters for the originally proposed 1,000 organisms/100 ml limitation. The Division remains confident that the 1,000 limitations is adequate to protect public health as related to the existing use of the Bull Canal. However, in being responsive to the requests of the permittee and because of the concern of local residents, this Division has included the 200 limitation in the permit. This in no way is to be construed as setting precedent or acknowledging the technical and public health need for such a limit.

Regarding the proposed conditions that Northglenn provide adequate disinfection to the Dacono water system and provide tailwater control facilities, it is the Division's position that conditions such as these are not within the purview of the permit program which is directed to effluent quality. These conditions, therefore will not be placed in the permit. The 200 fecal coliform limitation should satisfy any concern.

Other issues have been identified. These are:

1. the potential of groundwater pollution from lagoons and reservoir seepage;
2. the potential of safety hazard from reservoir embankment failure;
3. potential odor problem;
4. effect on relative land values adjacent to the treatment site;
5. visual or aesthetic effect of the facilities;

The facility has been designed to minimize seepage from the lagoons and reservoir. However, there is always the potential of seepage finding its way to groundwater. Because groundwater in the area is used for domestic needs by nearby residence, contamination of this supply is of obvious concern. Therefore, the Division has included in the permit a requirement that Northglenn develop a groundwater monitoring program acceptable to this Division. The frequency of this groundwater monitoring has been changed from quarterly to monthly sampling which will provide a broader data base in which to evaluate the facility and which will provide more responsiveness should contaimination of the groundwater be detected. A contigency plan, a permit requirement, is also to address steps Northglenn will take should contamination of groundwater be shown to be attriburable to Northglenn's operation. Northglenn will also monitor the Bull Canal for evaluation of the impact of its operation.

Concern has been expressed over the structural saftey of the reservoir embankment. The design has been reviewed by the State Engineer's office and found to be acceptable. Concern for potential odor problems from the facility has also been expressed. Though there is always a potential odor problem from a sewage treatment facility, proper operation of the facility - a necessity in order to meet the NPDES permit effluent limitations - will minimize any odor potential. Specifically, odor cannot be regulated in a NPDES permit.

The aesthetic effect of the facility and the facility's impact on adjacent land values are issues which cannot be addressed in the NPDES permit process. These have been considered during the site approval process.

A concern has been raised that should a permit violation occur, what mechanism would be available to notify regulatory authorities. Standard language in all permits requires the permittee to notify in writing the WQCD and EPA within 5 days the permittee is aware of a violation. Because of the nature of the discharge (i.e. intermittant releases of large volumes of water) and the concern over public health, language has been added to the permit requiring Northglenn to orally notify the WQCD and EPA within 24 hours of becoming aware of a violation.

There have been considerable comments expressed over the potential effects of nitrates from the discharge on agricultural and water supply uses of Bull Canal water. Public comments received indicate that the anticipated relatively high levels of nitrates in the Bull Canal water can adversely affect some nitrogen sensitive corps, i.e. crops such as sugar beets which do not require nitrogen beyond a certain growth stage. Statements have been made that contracts between farmers and a sugar beet processor do not allow application of fertilizer beyond July 15 of the year.

The Division responds to this in two ways. First, a nitrogen balance using historic irrigating practices shows that the amount of nitrates attributable to the effluent is small compared to the amount from applied commercial fertilizer. Besides, even commercial fertilizer applied before July 15th remains available in the soil. Secondly, the Bull Canal is unclassified and without a numeric standard for nitrates. Until a numeric standard is applied, the Division does not feel it is appropriate to include a nitrate limitation in the permit.

For the reason given above, a nitrate limitation has not been included to protect a potential drinking water supply use. If the Bull Canal is designated a drinking water supply usage in the reclassification process, then the permit can be appropriately amended. The permit does contain the standard reopener clause which allows the permit to be revised should water quality standards and/or the classification of the receiving stream be changed. It should also be pointed out that runoff from agricultural land back to Bull Canal will contribute a signigicant amount of nitrates.

State Effluent Standards for BOD_5, Total Suspended Solids, Total Residual Chlorine, pH and Oil and Grease will be applicable to the discharge. The designated discharge point will remain the end of the outfall conduit to Bull Canal. A compliance schedule for the development of an industrial pretreatment program is also a requirement of the permit. The permit is set to expire on June 30, 1983.

Jim Chubrilo
May 15, 1980

Permit No.: CO-0036757

County: Weld

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et. seq.; the "Act"), and the Colorado Water Quality Control Act (25-8-101 et. seq., CRS, 1973 as amended)

the City of Northglenn

is authorized to discharge from their Northglenn/FRICO Return Flow Facility,

located in the West ½ of Section 36, Township 1 North, Range 68 West of the 6th Principal Meridian, just north of the Adams/Weld County line,

to Bull Canal,

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Part I, II, and III hereof.

This permit shall become effective thirty (30) days after the date of receipt of this permit by the Applicant. Should the Applicant choose to contest any of the effluent limitations, monitoring requirements or other conditions contained herein, he must comply with Section 24-4-104 CRS 1973 and the Regulations for the State Discharge Permit System. Failure to contest any such effluent limitations, monitoring requirement, or other condition is consent to the condition by the Applicant.

This permit and the authorization to discharge shall expire at midnight,

June 30, 1983.

Signed this 4th day of June

COLORADO DEPARTMENT OF HEALTH

Gary G. Broetzman
Director
Water Quality Control Division

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - SEE ANY ADDITIONAL REQUIREMENTS UNDER PART III.

1. Effluent Limitations

During the period beginning no later than immediately and lasting through June 30, 1983, the permittee is authorized to discharge from outfall(s) serial number(s): Discharge Point 001, the end of the outfall conduit from the storage reservoir to the Bull Canal as referenced in Figure 1 & 2, Pages 21 and 22:

Effluent Parameter	Discharge Limitations Maximum Concentrations mg/l 30-day avg.		mg/l 7-day avg.		mg/l Daily Max.	
BOD_5	30	a/	45	b/	N/A	
Total Suspended Solids	30	a/	45	b/	N/A	
Fecal Coliforms-Number/100ml	200	c/	400	c/	N/A	
Total Residual Chlorine	N/A		N/A		0. 5	d/h/

pH - units shall remain between 6.0 and 9.0 d/.

Oil and Grease shall not exceed 10 mg/l d/ in any grab sample nor shall there be a visible sheen.

This permit may be modified, or revoked and reissued to comply with any applicable water quality standards and/or the classification of the receiving stream if the standards are changed and/or the stream is reclassified.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Continued)

2. Monitoring Requirements

In order to obtain an indication of the probable compliance or non-compliance with the effluent limitations specified in Part I, the permittee shall monitor and report all effluent parameters at the following required frequencies.

Effluent Parameter		Measurements Frequency i/	Sample Type f/
Flow - MGD (AF)		Daily	Daily Totalized
BOD_5 - mg/l	g/	**	Grab
Total Suspended Solids - mg/l	g/	**	Grab
Fecal Coliforms - Number/100 ml		Daily	Grab
pH		Daily	Grab
Oil and Grease		**	Visual
Total Residual Chlorine - mg/l		Daily	Grab

** Samples shall be taken according to the following schedule:

Effluent Discharged Million Gallons/Week	Required No. of Samples
0 - 58	one per week
59 - 116	two per week
117 - 174	three per week
≥ 175	four per week

This permit may be modified to require more or less frequent monitoring if operating data so justifies.

See pages 7 and 17 of 22 for additional monitoring requirements.

Self-monitoring samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): 001, end of the outfall conduit form the storage reservoir to Bull Canal as referenced in Figures 1 and 2, pages 21 & 22.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Continued)

3. Footnotes

a/ This limitation shall be determined by the arithmetic mean of a minimum of three (3) consecutive samples taken on separate weeks in a 30-day period (minimum total of three (3) samples); not applicable to fecal coliforms - see footnote c/.

b/ This limitation shall be determined by the arithmetic mean of a minimum of three (3) consecutive samples taken on separate days in a 7-day period (minimum total of three (3) samples); not applicable to fecal coliforms - see footnote c/.

c/ Averages for fecal coliforms shall be determined by the geometric mean of a minimum of three (3) consecutive grab samples taken during separate weeks in a 30-day period for the 30-day average, and during separate days in a 7-day period for the 7-day average. (minimum total of three (3) samples).

d/ Any discharge beyond this limitation as indicated by any single analysis and/or measurement shall be considered a violation of the condition of this permit.

e/ Quarterly samples shall be collected during the months of March, June, September, December, if a continual discharge occurs. If the discharge occurs on an intermittent basis, all the samples shall be collected during the period when that intermittent discharge occurs.

f/ See definitions, Part B.

g/ In addition to monitoring the final discharge, influent samples shall be taken and analyzed for this parameter at the same frequency as required as for this parameter in the discharge.

h/ Monitoring is required only when chlorine is used for disinfection.

i/ Monitoring is required only during periods of discharge. If "no discharge" occurs, this shall be reported at the specified frequency. (See Part B).

B. MONITORING AND REPORTING

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous month shall be summarized for each month and reported on applicable discharge monitoring report forms, postmarked no later than the 28th day of the month following the completed reporting period. The first report is due no later than the 28th day of the month following the month in which discharge commences. If no discharge occurs, "No Discharge" shall be reported. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Colorado Department of Health
Water Quality Control Division
4210 East 11th Avenue
Denver, Colorado 80220

U.S. Environmental Protection Agency
1860 Lincoln Street - Suite 103
Denver, Colorado 80295
Attention: Enforcement - Permit Program

3. Definitions

a. A "composite" sample, for monitoring requirements, is defined as a minimum of four (4) grab samples collected at equally spaced two (2) hour intervals and proportioned according to flow.

b. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

c. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement using existing monitoring facilities.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(h) of the Act, and Colorado State Effluent Limitations (10.1.4), under which such procedures may be required.

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1), or other forms as required by the Division. Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State Water Quality Control Division.

C. SCHEDULE OF COMPLIANCE/BEST MANAGEMENT PRACTICES

The permittee shall manage the facilities to protect the existing beneficial uses of the Bull Canal and ensure protection of public health. Because of the unique situation of intergrated treatment, Storage and canal facilities, the management and operation of the system will likely determine how effective the permittee is in protecting public health. Therefore, the permittee shall design a management and mitigation program and submit it to the Water Quality Control Division at least 365 days prior to the initial discharge. The program shall be subject to the approval of the Division and the EPA. This program shall at a minimum address the following:

1. Bull Canal Monitoring Program. The City of Northglenn has submitted to the WQCD a plan for monitoring the parameters BOD, Fecal Coliform, Total Nitrogen, Nitrate Nitrogen, Chloride, Total Dissolved Solids, Iron, and Cadmium at the following locations:

    a. Bull Canal upstream of Discharge Point 001 designated in this permit; (sampled weekly)

    b. Bull Canal at Dacono; (sampled weekly)

    c. Discharge from terminal reservoir to Coal Ridge Ditch. (Sampled daily)

The City of Northglenn and the WQCD will mutually establish the exact monitoring station locations.

2. Contingency Plan. The permittee should address what steps will be taken should an upset condition occur whereby the effluent from the storage reservoir is of a quality which does not or will not meet effluent limitations and which might be deterimental to public health. Also, the permittee should address what measures the City of Northglenn will undertake if groundwater under the facility site are shown to be contaminated by the permittee's operations.

D. SCHEDULE OF COMPLIANCE FOR PRETREATMENT PROGRAM DEVELOPMENT

Under the authority of Section 307(b) and 402(b)(8) of the Clean Water Act, and implementing regulations (40CFR 403), the permittee is required to develop a pretreatment program. This program shall enable the permittee to detect and enforce against violations of categorical pretreatment standards promulgated under Section 307(b) and (c) of the Clean Water Act and prohibitive discharge standards as set forth in 40 CFR 403.5.

On or before the dates specified below, the permittee shall accomplish Items 1 through 15 , in order to implement an approvable pretreatment program. The permittee shall:

1. Submit Evaluation of Present Legal Authorities by June 30, 1980.

*2. Submit Listing of Industrial (Non-Domestic) Users by June 30, 1980.

3. Submit Draft Industrial Waste Ordinance, Agreement, or Contract(s) by October 30, 1980.

4. Submit Results of Sampling and Analysis of Industrial Inputs to POTW System by December 31, 1980.

5. Submit Implementation Verification of Necessary Additional Legal Authorities by June 30, 1981.

6. Submit Evaluation of Funding Mechanisms (User Charges, etc.) to Sustain Approved Program by June 30, 1981.

7. Submit Draft Program for Industrial Input Monitoring by POTW and/or Industries by October 30, 1981.

8. Submit Determination of Necessary Additional Monitoring/Analysis Equipment and Structures by October 30, 1981.

9. Submit Specific Limits for Industrial Inputs Identified as Prohibited Discharges by December 31, 1981.

10. Submit Finalized Industrial Waste Ordianance, Agreement, or Contract(s) by March 31, 1982.

11. Submit Finalized Program for Industrial Input Monitoring by POTW and/or Industries by June 30, 1982.

12. Submit Completed Analysis for Categorical Standards Removal Allowances, if Appropriate by June 30, 1982.

SCHEDULE OF COMPLIANCE FOR PRETREATMENT PROGRAM DEVELOPMENT - (Continued)

14. Submit Request for Pretreatment Program Approval by October 30, 1982.

15. Attain Approval of Pretreatment Program by March 31, 1983.

16. Attain Total Program Implementation by July 1, 1983.

* Upon review of this submittal, the Water Quality Control Division may determine that the subsequent items will not be required for submittal.

The terms and conditions of the POTW pretreatment program, when approved, shall be enforceable automatically through the permittee's NPDES permit.

No later than 14 calendar days following a date identified in the above pretreatment schedule, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

Any application for authority to revise categorical pretreatment standards to reflect POTW removal of pollutants in accordance with the requirements of 40 CFR 403.7 must be submitted to the permit-issuance authority at the time of application for POTW pretreatment program approval or at the time of permit expiration and reissuance thereafter.

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated change in discharge location and/or facility expansions, production increases, or process modifications which will result in new, different, or increased discharges or pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the State Water Quality Control Division of such changes. Process modifications include, but are not limited to, the introduction of any new pollutant not previously identified in the permit, or any other modifications which may result in a discharge of a quantity or quality different from that which was applied for. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. Noncompliance Notification

a. If, for any reason, the permittee does not comply with any maximum effluent limitation specified in this permit the permittee shall provide the Regional Administrator and the State Water Quality Control Division with the following information, in writing, within five (5) days of becoming aware of such condition:

(1) A description of the discharge and cause of noncompliance; and

(2) The period of noncompliance, including exact dates and time; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

b. The permittee shall orally notify the Water Quality Control Division and EPA within 24 hours of becoming aware of a permit violation.

c. The permittee, as soon as it has knowledge thereof, shall notify the State Water Quality Control Division of any spill or discharge of any pollutant, not otherwise authorized in this permit, which may cause pollution of waters of the State.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to waters of the State resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. Bypassing (see additional requirements under Part III)

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit, or any activity that results in the avoidance of any required treatment for any process or run-off water, is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State Water Quality Control Division in writing of each such diversion or bypass.

6. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering waters of the State.

7. Power Failures

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. Provide an alternative power source sufficient to operate the wastewater control facilities;

   or, if such alternative power source is not in existence, and no date for its implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

8. Any discharge to the waters of the State from a point source other than specifically authorized is prohibited.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Director of the State Water Quality Control Division, the EPA Regional Administrator, and/or their authorized representative, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit and to inspect any monitoring equipment or monitoring method required in the permit.

c. To enter upon the permittee's premises to reasonably investigate any actual, suspected, or potential source of water pollution, or any violation of the Colorado Water Quality Control Act. The investigation may include, but is not limited to, the following: sampling of any discharge and/or process waters, the taking of photographs, interviewing of any persons having any knowledge related to the discharge, permit, or alleged violation, and access to any and all facilities or areas within the permittee's premises that may have any affect on the discharge, permit, or alleged violation.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilites from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State Water Quality Control Division.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act, Section 25-8-405 of C.R.S. 1973 and Regulations for the State discharge permit system 6.1.8, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State Water Quality Control Division and the Regional Administrator.

As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act, and CRS (1973) 25-8-610.

4. Permit Modification

After notice and opportunity for a hearing, the permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that required either a temporary or permanent reduction or elimination of the authorized discharge. Changes in water quality standards, control regulation or duly promulgated plans would qualify as "a change in any condition."

5. Toxic Pollutants

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307 (a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Permit Violations

Failure to comply with any terms and/or conditions of this permit shall be a violation of this permit.

10. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

11. Severability

The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

12. At the request of a permittee, the Division may modify or terminate a permit and issue a new permit if the following conditions are met:

(a) The Regional Administrator has been notified of the proposed modification or termination and does not object in writing within thirty (30) days of receipt of notification, and

(b) The Division finds that the permittee has shown reasonable grounds consistent with the Federal and State statutes, and regulations for such modification or termination and

(c) Requirements of public notice have been met.

OTHER REQUIREMENTS

Additional Bypassing Requirements

If, for other reasons, a partial or complete bypass is considered necessary, a request for such bypass shall be submitted to the State Water Quality Control Division and to the Environmental Protection Agency at least sixty (60) days prior to the proposed bypass. If the proposed bypass is judged acceptable to the State Water Quality Control Division and by the Environmental Protection Agency, the bypass will be allowed subject to limitations imposed by the State Water Quality Control Division and the Environmental Protection Agency.

If, after review and consideration, the proposed bypass is determined to be unacceptable by the State Water Quality Control Division and the Environmental Protection Agency, or if limitations imposed on an approved bypass are violated, such bypass shall be considered a violation of this permit; and the fact that application was made, or that a partial bypass was approved, shall not be defense to any action brought thereunder.

Testing

Test procedures shall conform with those procedures specified in the Federal Register, Volume 38, Number 199, October 16, 1973. These procedures involve the use of the latest edition of one of the following references:

1. "Standard Methods for the Examination of Water and Waste Water",

2. "ASTM", Annual Book of Standards, Part 23, Water, Atmosphere Analysis,

3. "Methods for Chemical Analysis of Waters and Wastes", Environmental Protection Agency.

Discharge Point(s)

Discharge points shall be so designed or modified that a sample of the effluent can be obtained at a point after the final treatment process and prior to discharge to State waters.

OTHER REQUIREMENTS (Continued)

Within three (3) months after the effective date of this permit, a flow-measuring device shall be installed to give representative values of effluent volume at some point in the plant circuit, if not already a part of the wastewater plant.

The following locations of flow-measuring devices are required:

1. Facilities with detention times within the treatment system of 24 hours or less: on the influent or effluent line, or within the system.
2. Facilities with detention times within the treatment system of 24 hours or more: on the effluent line.

If permittee desires to locate a flow-measuring device in a location other than in 1 or 2 above, then permittee shall submit a request to the Division giving the specific location (by map). The request shall include a justification that the location will give accurate measurements within ten (10) percent of the actual flow being discharged. Installation shall be subject to approval by the Division prior to installation.

At the request of the Regional Administrator of the Environmental Protection Agency or the Director of the State Water Quality Control Division, the permittee must be able to show proof of the accuracy of any flow-measuring device used in obtaining data submitted in the monitoring report. The flow-measuring device must indicate values within ten (10) percent of the actual flow being discharged from the facility.

The limitations stated in PART I, Section A, are calculated on the basis of gross measurements of each parameter in the designated discharge regardless of the quantity and quality of these parameters in the plant flow unless otherwise specified.

If the permittee desires to continue to discharge, he shall re-apply at least one hundred-eighty (180) days before this permit expires.

Within sixty (60) days of the effective date of this permit, the permittee shall file a statement with the Environmental Protection Agency and the State Water Quality Control Division which shall contain the names of the person or persons who are designated to report conditions as noted in PART II, Section A, Paragraph 2a (Noncompliance Notification), and as noted in PART II, Section B, Paragraph 7 (Oil and Hazardous Substance Liability). The permittee shall continually update this list as changes occur at the facility.

The permittee is required to submit an annual fee as set forth in Section 25-8-502 C.R.S. 1973 as amended. Failure to submit the required fee is a violation of this permit and will result in the suspension of said permit and enforcement action pursuant to Section 25-8-601 et. seq., 1973 as amended.

OTHER REQUIREMENTS (Continued)

Expansion Requirements

Pursuant to Colorado Law, C.R.S. 1973 25-8-501(6), the permittee is required to initiate engineering and financial planning for expansion of the treatment works whenever throughput and treatment reaches eighty (80) percent of design capacity. Whenever ninety-five (95) percent of either the hydraulic or organic capacity of the treatment works is met, the permittee shall commence construction of the necessary treatment expansion.

In the case of a municipality, construction may be commenced, or building permit issuance may be terminated, until such construction is initiated, except that building permits may continue to be issued for any construction which would not have the effect to increasing the input of sewage to the municipal treatment works.

OTHER REQUIREMENTS (Continued)

GROUNDWATER MONITORING PROGRAM

The permittee shall submit a report to the Water Quality Control Division no later than 180 days prior to the commencement of operational status of the treatment facility.

This report on a proposed groundwater monitoring program designed to monitor any movement of pollutants into the groundwater in the area of the treatment site. Monitoring wells shall be situated so as to monitor groundwater quality inside the site, in each dominant direction of groundwater movement away from the site, and background water quality for groundwater entering the site. The report shall also contain the following information as a minimum:

1. A large scale topographic map of the site and surrounding area. This map shall show the location and estimate water levels of the proposed groundwater monitoring points, including an estimate of the rate of groundwater movement and the direction of the groundwater gradient.

2. A description of the proposed monitoring wells including casing size and the perforated zone of the casing and the method of installation.

3. A description of the method of sampling and a listing of the analyses to be performed on the wastewater plus water removed from background and down-gradient groundwater quality monitoring points. The following analyses shall be performed at least on a monthly basis for each monitoring point:

   a) Nitrate and Ammonia Nitrogen, mg/l
   b) Total Dissolved Solids, mg/l
   c) COD, mg/l
   d) Fecal Coliform, #/100 mg
   e) Chlorides, mg/l
   f) Iron
   g) Cadmium

   Before sampling, all monitoring wells must be pumped for a minimum of ten minutes. Wells should be capped and locked when not sampling.

4. Groundwater uses in the area. Show location of all wells (domestic, irrigation, etc.) in and within one-half mile of site.

Upon approval of the program by the Division, the monitoring points shall be installed and the first monitoring report submitted no later than sixty (60) days prior to the commencement of operational status of the treatment facility. Monitoring reports shall be submitted on a monthly basis thereafter and shall contain, at a minimum, the following information:

1. Monitoring point locations and numerical identification;
2. Monitoring well depth, surface elevation of well, and depth to static water level of well;
3. The required analyses and the date the sample was taken for each monitoring point.

OTHER REQUIREMENTS (continued)

Industrial Wastes

A. As part of the pretreatment program development compliance schedule contained in Part I of this permit, the permittee is required to submit a list of industrial contributors to the treatment facility by October 30, 1980. The permittee is also required to submit the results of a sampling and analysis program of the individual industries by June 30, 1981. This program shall include the identification of quantitative and qualitative characteristics of the individual industrial imputs as well as production data, where applicable, for at least the industrial contributors for which categorical pretreatment standards have been or will be developed (refer to Paragraph D of this section). Subsequent to the above initial submission, the permittee shall continue to monitor and analyze these industrial inputs on a routine basis, and shall submit the results to the Division of this ongoing monitoring effort at six (6) month intervals on June 30th or December 31st of each calendar year.

B. The permittee must notify the Division of any new introductions by new or existing sources or any substantial change in pollutants from any industrial source. Such notice must contain the information described in "A" above and be forwarded no later than sixty (60) days following the introduction or change.

C. Pollutants introduced into the treatment facility by any source of a nondomestic discharge shall not inhibit or interfere with the operation or performance of the facility. The following pollutants may not be introduced into the facility:

1. Pollutants which create a fire or explosion hazard in the facility;

2. Pollutants which will cause corrosive structural damage to the facility, but in no case discharges with pH lower than 5.0, unless the facility is specifically designed to accommodate such discharges;

3. Solid or viscous pollutants in amounts which will cause obstruction to the flow in sewers, or other interference with the operation of the facility;

4. Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge of such volume or strength as to cause interference in the facility;

5. Heat in amounts which will inhibit biological activity in the facility resulting in interference, but in no case heat in such quantities that the temperature at the treatment facility influent exceeds 40°C (104°F) unless the facility is designed to accommodate such heat.

D. In addition to the general limitations expressed above, more specific pretreatment limitations have been and will be promulgated for specific industrial categories under Section 307 of the Act, including but not limited to, those listed below. Compliance with these regulations is required no later than three (3) years following the date of promulgation: (See 40 CFR, Subchapter D, Parts 400 through 500, for specific information).

OTHER REQUIREMENTS (Continued)

Automatic and Other Laundries
Coal Mining
Electroplating
Inorganic Chemicals Manufacturing
Iron and Steel Manufacturing
Leather Tanning and Finishing
Machinery and Mechanical Products Manufacturing
Miscellaneous Chemicals Manufacturing
Nonferrous Metals Manufacturing
Ore Mining
Organic Chemicals Manufacturing
Paint and Ink Formulation and Printing
Paving and Roofing Materials
Petroleum Refining
Plastic and Synthetic Materials Manufacturing
Pulp and Paperboard Mills and Converted Paper Products
Rubber Processing
Soap and Detergent Manufacturing
Steam Electric Power Plants
Textile Mills
Timber Products Processing

E. At such time as a specific pretreatment limitations become applicable to an industrial contributor, the permit issuing authority may, as appropriate, do the following:

(1) Amend the NPDES discharge permit to specify the additional pollutant(s) and corresponding effluent limitations(s) consistent with the applicable national pretreatment standards;

(2) Require the permittee to specify, by ordinance, contract, or other enforceable means, the type of pollutant(s) and the maximum amount which may be discharged to the permittee's facility for treatment;

(3) Require the permittee to monitor its discharge for any pollutant which may likely be discharged from the permittee's facility, should the industrial contributor fail to properly pretreat its waste.

The permit issuing authority retains, at all times, the right to take legal action against the industrial contributor or the treatment works, in those cases where a permit violation has occurred because of the failure of an industrial contributor to discharge at an acceptable level. If the permittee has failed to properly delineate maximum acceptable industrial contributor levels, the permitting authority will look primarily to the permittee as the responsible party unless the contributor's discharge is obviously unaccceptable under 40 CFR, Subchapter D - Water Programs.

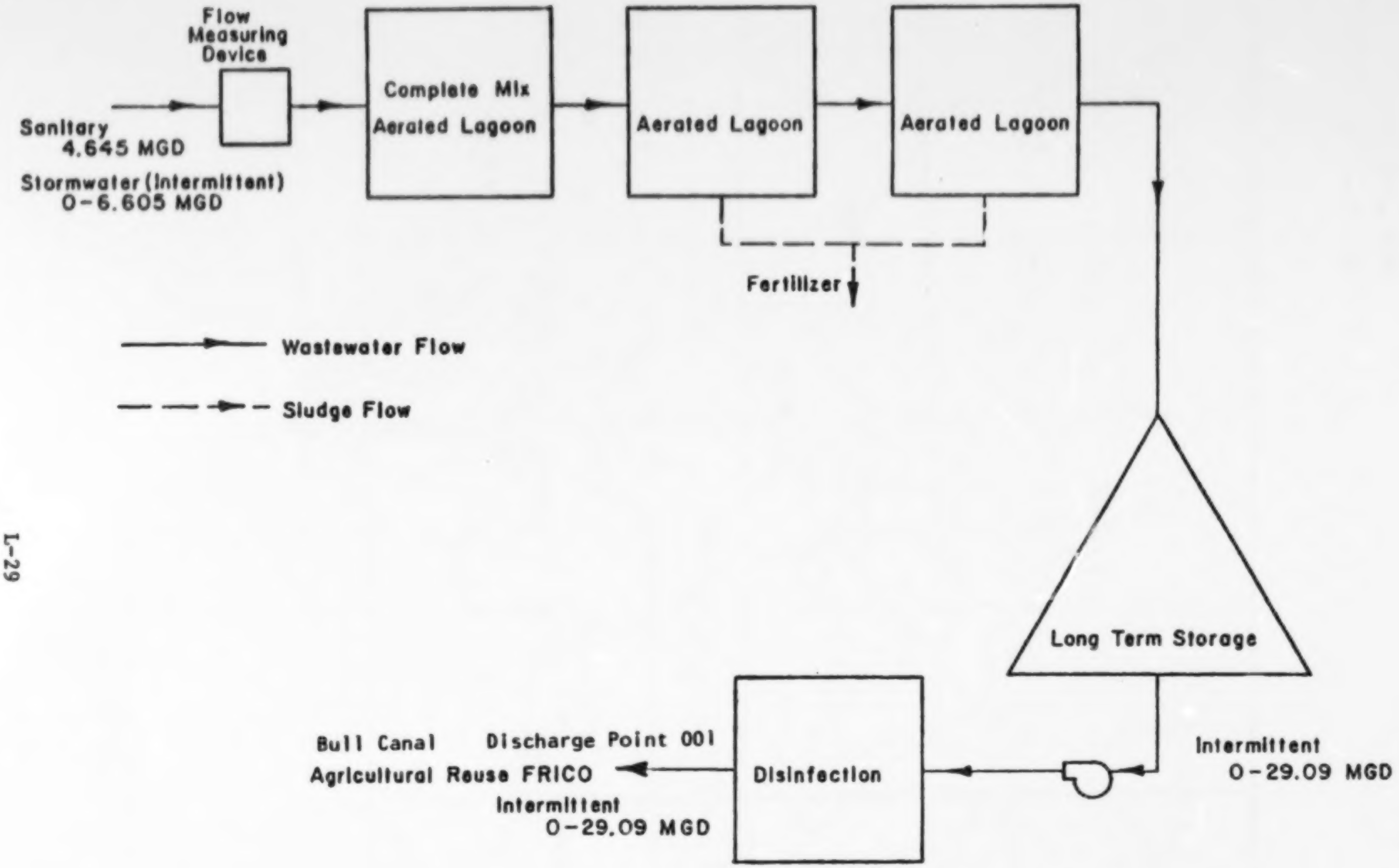

Flow Measuring Device
Sanitary 4.645 MGD
Stormwater (Intermittent) 0-6.605 MGD
Complete Mix Aerated Lagoon
Aerated Lagoon
Aerated Lagoon
Fertilizer
Wastewater Flow
Sludge Flow
Long Term Storage
Intermittent 0-29.09 MGD
Disinfection
Bull Canal
Discharge Point 001
Agricultural Reuse FRICO
Intermittent 0-29.09 MGD

FIGURE 1

CITY OF NORTHGLENN

SCHEMATIC FLOW DIAGRAM MULTI-CELL AERATED LAGOON

NORTHGLENN/FRICO RETURN FLOW FACILITY

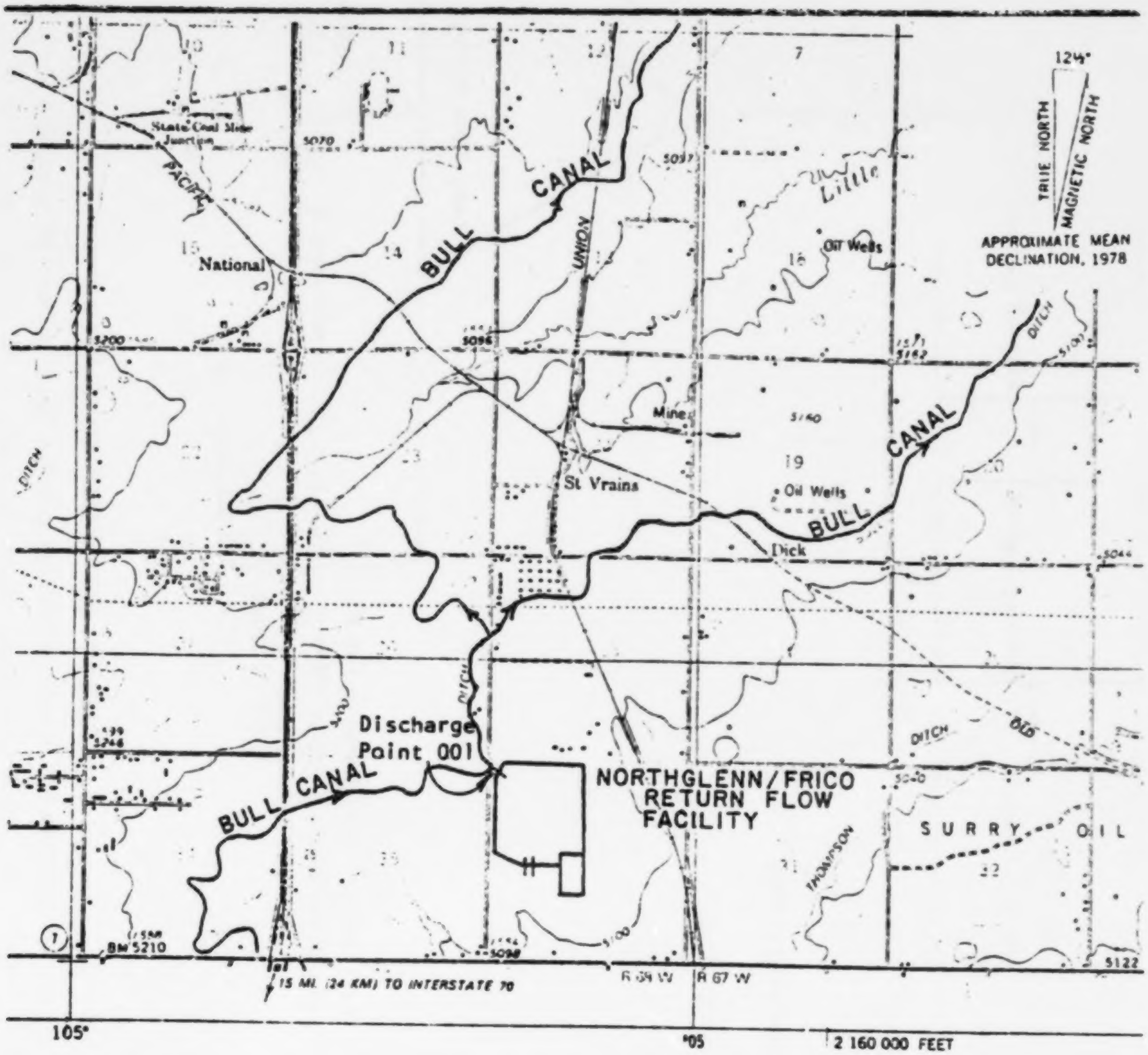

124°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1978
State Coal Mine Junction
PACIFIC
National
BULL CANAL
UNION
Little
Oil Wells
Mine
St Vrains
Oil Wells
BULL CANAL
Dick
DITCH
Discharge Point 001
NORTHGLENN/FRICO RETURN FLOW FACILITY
BULL CANAL
THOMPSON
DITCH
OLD
SURRY OIL
BM 5210
15 MI. (24 KM) TO INTERSTATE 70
R 68 W
R 67 W
105°
'05
2 160 000 FEET
5122

FIGURE 2

CITY OF NORTHGLENN TREATMENT FACILITY
LOCATION MAP

APPENDIX M

SOUTH PLATTE - DEEP WELL ALTERNATIVE

M-0

Appendix M

South Platte-Deep Well Alternative

As explained in Chapter 4, another alternative water supply for Northglenn was presented to EPA just prior to completing the final EIS. The following alternative analysis was developed too late to be included within Chapter 4; however, EPA believes this alternative warrants discussion. This analysis therefore, is presented here for review by interested public and governmental officials.

As explained in the EIS, Northglenn decided to purchase South Platte surface water (from Consolidated Ditches among others) to secure sufficient make-up water following denial by the State Engineer of their requested deep well permits. Based on recent opinions of the Water Court, it now appears that Northglenn will be permitted some if not all of the deep well water applied for. If so, Northglenn could drill and produce this water, thereby having excess supply for its design year needs. Northglenn indicates it would likely sell the South Platte Consolidated Ditch water if deep well water is developed.

South Platte-Deep Well Alternative Presented by Opponents to the Proposed Plan

On May 21, 1980, representatives of the Consolidated Ditches Company presented the South Platte-Deep Well alternative to EPA. This was followed by a meeting on May 29, 1980, with representatives of Northglenn, Consolidated Ditches, and EPA to discuss this option. A letter explaining this option from Mr. Raymond Hogan copied to EPA is included in this appendix.

The suggested alternative by Consolidated Ditches Company is to combine the deep well source and the South Platte surface for raw water delivery. In a dry year, Northglenn's demand is projected to be 7340 acre-feet per year. To supply this amount, Northglenn could use Clear Creek water rights (Farmers Highline, Church Ditch, and Berthoud Pass Ditch) totaling 324 acre-feet, already purchased by FRICO shares totaling 1070 acre-feet, and 2300 acre-feet from deep wells. Actually, Northglenn's deep well yield would likely be less than 2300 acre-feet since some land owners may not grant permission to Northglenn to pump their share of this water. Consolidated Ditches suggests the remaining requirement for 3600 to 4000 acre-feet could be pumped directly from the South Platte by means of the proposed tributary well field or in combination with diverting additional water from Grange Hall Creek. Under these circumstances, an exchange with FRICO is no longer essential and presumably a wastewater system of transporting sewage to Denver-Metro could be implemented. The South Platte raw water could be treated at the Nortrhglenn water supply treatment facility now under construction. The South Platte water would be diverted an accordance with the priority system and Northglenn would return the historic depletion through Denver Metro supplemented as necessary by release from storage.

As presented by Consolidated Ditches Company, this alternative may require Northglenn to deliver to FRICO, 500 acre-feet per year in order to break the FRICO exchange agreement. Under the Consolidated Ditches plan, the total consumptive use to the South Platte would be 3010 acre-feet. Northglenn's replacement sources appear to be adequate to replace this consumptive use. These sources include the historic depletion credit for both the Clear Creek and South Platte ditch rights, credit for the historic agricultural depletion of the FRICO shares owned by Northglenn, and the total ammount of water pumped from the nontributary wells. The replacement water will be returned to the stream system at Denver Metro supplemented by returns at other points or storage releases which may be necessary to protect specific rights from injury.

Although EPA has not performed a cost analysis, the costs may be expected to be somewhat higher than the proposed plan. Increased cost of pipeline, pumping, treatment, storage and delivery to Denver Metro plus the costs of upgrading and expanding the Metro facility must be factored in. In addition, the cost of the negotiation of some agreement under which Northglenn could connect to the Denver Metro plant would be required. Water quality of this source may pose a problem similar to that experienced by Thornton regarding their South Platte wells. If this South Platte supply was obtained above the Denver Metro outfall, then costs would further increase.

If the proposed exchange plan is implemented, initially, Thornton will divert less water due to Northglenn's withdrawal from the system. As Thornton extends it service and water demand increases, Thornton will again divert water now delivered to Northglenn. If such deliveries are made under the GASP program for five percent augmentation as currently the case, no change would occur in river flow over present conditions. If such deliveries are made under a full augmenttion requirement, then the additional replacement requirements placed on Thornton would mean Thornton must provide replacement water equal to its total consumption use resulting in a greater river flow. Under the South Platte-Deep Well Alternative, additional return flow to the South Platte may result from Northglenn developing the new deep well source.

As previously stated, the proposed plan to delivery water to Northglenn from South Platte ditches will not affect stream flow since full augmenttion of surface diversions is required under Colorado water rights law. As explained above, Northglenn's withdrawal from the Denver Metro facility will not affect river flow either. However, implementation of the South Platte-Deep Well Alternative could slightly increase river flow due to development of a non-tributary source.

EPA concludes that the South Platte-Deep Well Alternatives, along with the Denver Metro wastewater system, has certain advantages including additional water available to South Platte irrigators and negates the need to mitigate certain public health risks associated with the proposed exchange. Conversely, this proposal would not include those benefits to agriculture as explained in Chapter 4 and would again expose FRICO agriculture water to condemnation action. As previously explained, implementation of EPA required mitigation measures for the proposed exchange plan does not create a public health hazard. Therefore, EPA concludes that since the South Platte-Deep Well Alternative does not provide the agricultural benefits of the proposed plan, it is not as favorable as the proposed exchange plan.

W. W. WHEELER AND ASSOCIATES, INC.
CONSULTING ENGINEERS
SUITE 201
770 WEST HAMPDEN AVENUE
ENGLEWOOD, COLORADO 80110

PHONE
761-4131

May 22, 1980

Mr. Gregory J. Hobbs, Jr.
Davis, Graham & Stubbs
2600 Colorado National Building
950 Seventeenth Street
Denver, Colorado 80202

Re: #814 Consolidated Ditch-EPA

Dear Greg:

Attached is a Northglenn Water Use Schematic which depicts a basic alternative to Northglenn's water management plan. The purpose of this letter is to explain the basic alternative plan and to suggest that EPA study the feasibility of this alternative in the final EIS.

The basic assumption is made that Northglenn would not participate in the FRICO exchange or FRICO's reuse of Northglenn's sewage effluent. From an engineering point of view, it appears to us that Northglenn would still be obligated to provide FRICO with 500 acre-feet of bonus water.

In a dry year Northglenn's demand is projected to be 7,340 acre-feet. To supply this amount, Northglenn could obtain 320 acre-feet of water from its Clear Creek water rights, 1,070 acre-feet from its FRICO shares, and 2,000 acre-feet from deep wells. Northglenn's deep well yield was reduced from 2,300 acre-feet per year to 2,000 acre-feet per year to account for some land owners who may not grant permission to Northglenn to pump their share of deep well water. The remaining demand of 3,950 acre-feet would have to be supplied by other sources. There are at least three alternatives for supplying this water. First, Thornton could provide this supply. Second, Denver should be contacted to see if they would be willing to supply this water. Third, Northglenn could pump this water from the South Platte either directly or indirectly by means of a Grange Hall Creek diversion or through alluvial wells. This water could be treated at a treatment plant as proposed for Northglenn near Stanley Lake.

The total consumptive use or impact to the South Platte for this alternative would be 3,010 acre-feet. As shown in the table below, Northglenn's replacement sources appear to be more than adequate to balance this consumptive use.

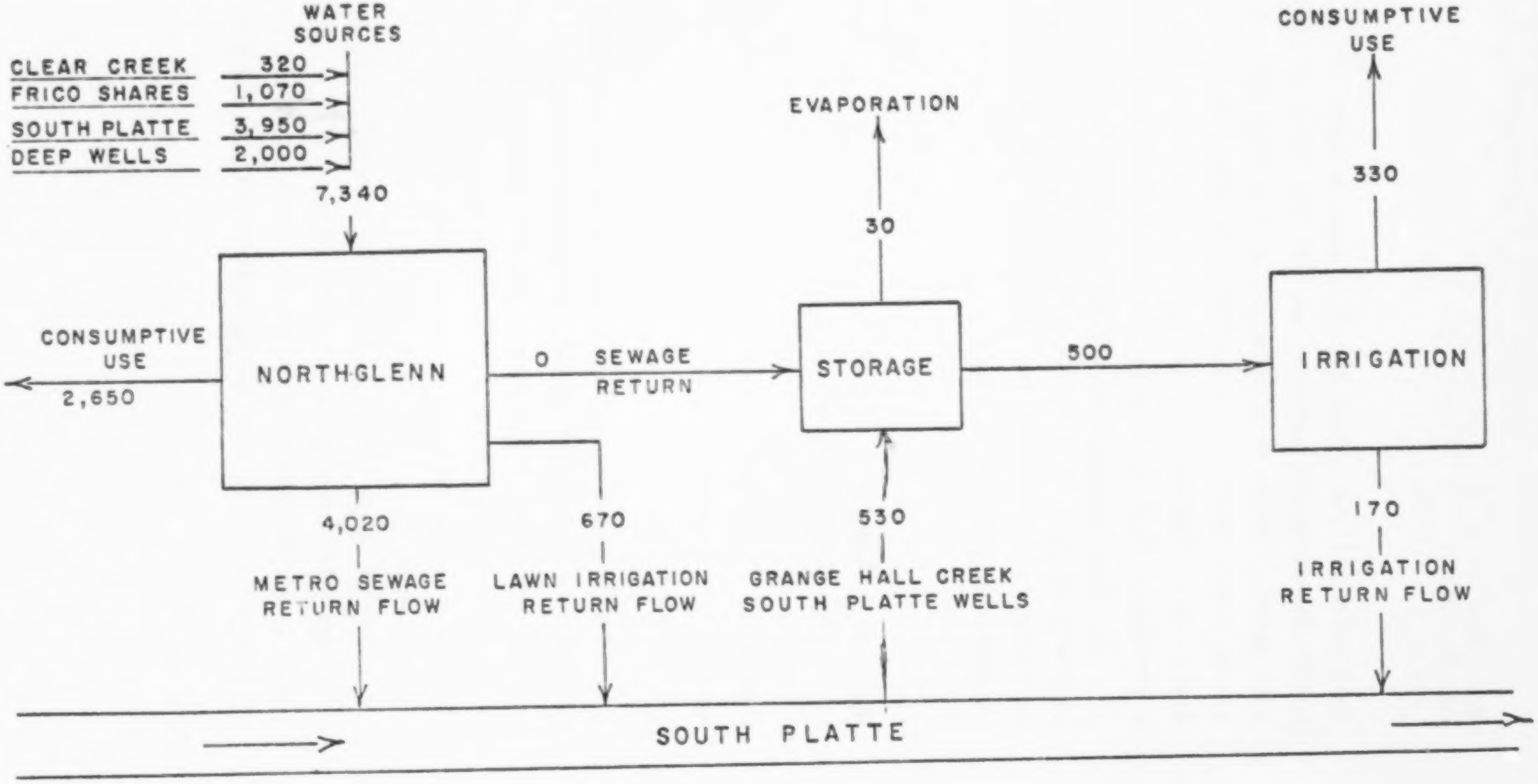
Replacement Source	Historical Consumptive Use or Replacement Credit (Acre-Feet)
Clear Creek Water Rights	320
FRICO Shares	420
Deep Wells	2,000
South Platte Ditches	1,990
Total	4,730

If Northglenn had not made the agreement with FRICO concerning the bonus, the consumptive use Northglenn would have had to compensate the river would be 2,480 acre-feet. It appears then, that without the FRICO agreement Northglenn could have provided 2,740 acre-feet of replacement water without purchasing the water rights in the South Platte ditches.

Although we have not performed an economic feasibility study, we suspect that this alternative would result in a smaller future charge to Northglenn's residents for water and sewer services than the projected charge for Northglenn's water management plan. This

NORTHGLENN WATER USE SCHEMATIC

FUTURE CONDITIONS - DRY YEAR
METRO SEWAGE - MINIMUM FRICO REPLACEMENT
SOUTH PLATTE - RAW WATER SUPPLY


WATER SOURCES
CLEAR CREEK 320
FRICO SHARES 1,070
SOUTH PLATTE 3,950
DEEP WELLS 2,000
7,340
CONSUMPTIVE USE
2,650
NORTHGLENN
0 SEWAGE RETURN
EVAPORATION
30
STORAGE
500
CONSUMPTIVE USE
330
IRRIGATION
4,020
METRO SEWAGE RETURN FLOW
670
LAWN IRRIGATION RETURN FLOW
530
GRANGE HALL CREEK SOUTH PLATTE WELLS
170
IRRIGATION RETURN FLOW
SOUTH PLATTE

NOTE: All quantities in acre-feet per year

TOTAL CONSUMPTIVE USE 3,010

APPENDIX N

ANALYSIS BY NORTHGLENN'S ENGINEER OF APPENDIX E

APPENDIX N

Analysis by Northglenn's Engineer of Appendix E

SHEAFFER & ROLAND, INC.
Chicago Washington, D.C. Denver
Environmental Planning & Engineering • Solar Energy • Resources Management

May 23, 1980

Mr. Wes Wilson
EPA Region VIII
Environmental Evaluations Branch
1860 Lincoln Street
Denver, Colorado 80295

Re: Engineering-Science's Review of Northglenn Proposed Wastewater Treatment System

Dear Mr. Wilson:

We received on May 9, 1980 a preliminary copy of a report prepared by Engineering Science entitled "A Review of Proposed Northglenn Wastewater Treatment System." Although Engineering Science's cover letter states that the preliminary report was sent only to the participants in the Northglenn treatment workshop conducted by EPA, unfortunately this was not the case. Consequently, a report containing discrepancies and errors is publicly distributed. Obviously, it will be difficult for you to correct this problem, but it is your responsibility to do so.

These comments are a part of the public discussion of the issues prior to the publication of a Final Environmental Impact Statement. In the spirit of scientific accuracy, these comments should be included as an integral part of the Final Environmental Impact Statement.

We have divided our comments into three areas of concern. The first is in regard to the data collection, pilot plant

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studies and the basis of design for the mechanical portions of the lagoon treatment. We can understand the hesitation on the part of Engineering Science to give a full endorsement to a design for which they are not responsible and the future professional liability which might be implied from such an endorsement. Nonetheless, most of the conclusions in the draft report are based on a misunderstanding of the data used in the design of the system and a superficial analysis of what "might," "could," or "maybe" happen in any mechanical design.

Our design is sensitive to these possibilities and several redundancies have been included in the design to prevent these possiblities from becoming actual problems. This design feature was overlooked in the review. Of course, no one can say with absolute certainty that this design or any other conventional treatment plant design will work without some operational problems until it is actually built and operated. This, however, does not lead a reasonable design engineer to conclude that such a system should not be built; if this were the case, no sewage treatment plants would ever be built.

The State of Colorado is eventually responsible for the approval of the sewage treatment plant design. This approval was secured by Northglenn in the summer of 1979 and there have not been any changes to the design since that approval. We believe this approval speaks for itself.

The only item of significant discussion is whether or not the treated wastewater, after long term storage in Bull Reservoir, will experience algae growth at a level in excess of 30 parts per million. Since the 30 parts per million algae (suspended solids) standard is not a public health issue, the EPA and the State of Colorado have consistently relaxed this standard for discharges from storage lagoons with a flow less than 2 mgd. This is particularly true of lagoons which discharge into streams used for irrigation purposes, since the algae growth is beneficial to irrigators as a highly stable form of organic nitrogen, and since it is not a signficant problem for downstream drinking water supplies.

Northglenn's flows will exceed 2 mgd and the system is not eligible for this exemption. Northglenn, therefore, has taken the 30 parts per million suspended solids standard as a given and has instructed our firm to provide them with a design which will meet the standard. Because the total system does not solely rely on the mechanical design, most of the discussion on the pros and cons of the mechanical system is not the key issue. The key issue is whether or not the entire system is capable of meeting the standards. Throughout the planning and design of the Northglenn system, we have consistently recommended to Northglenn that redundancies and contingency plans must be readily available for all of the mechanical elements of the plan. The control of algae is no exception in this regard. There are several candidate non-mechanical mitigation measures which are successfully practiced on a continuing basis throughout the country to limit the growth of algae in storage reservoirs. These mitigation measures are included as a part of the overall plan. Although it is not a common practice of the sanitary engineering profession to build such a high level of redundancy in conventional sewage treatment plant designs, we have done so in this case to provide the best practical assurances that the water quality standards on the Bull Canal will be met as a part of Northglenn's contractual obligations with FRICO.

The second area of concern is in regard to the comparison of the energy requirements for the Northglenn system and treatment at Metro Denver. The comparison presented by Engineering Science is misleading and unrealistic and does not follow EPA guidelines. EPA performed a proper analysis of the energy impacts as a part of the Negative Declaration on the project in the Fall of 1978. That analysis concluded that the Northglenn plan consumed less energy than treatment at Metro Denver. Since 1978, Metro Denver has published a draft Facility Plan describing in more detail the new facilities necessary to meet its discharge permit requirements, Thornton has decided to substantially reduce its participation in the Northglenn plan, and Northglenn has finalized its design. These changes have further enhanced the energy conservation aspects of the Northglenn plan. If the Northglenn wastes were to be treated at the Denver Metro Plant, 280 percent to 450 percent more energy per unit quantity of water treated would be required. The analyses to support this conclusion are included in this report.

The third area of concern is in regard to the mitigation measures for algae control. Although we understand that Engineering Science's report was not intended to provide conclusions on the workability of these control measures, the overall negative tone of the discussion is quite misleading to the general public. It implies that it is impractical to control algae in storage reservoirs. We both know this is not the case, and we are providing additional detailed supporting information.

We have organized our comments to respond to each of the fourteen preliminary conclusions of Engineering Science's report. For convenience, we have reproduced each of Engineering Science's preliminary conclusions as an introduction to our comments. This will facilitate the incorporation of our reponses into the final EIS. We trust this review has been provided in a timely manner. Please contact us if you have any further questions.

Sincerely,

SHEAFFER & ROLAND, INC.

F. Robert McGregor

F. Robert McGregor, P.E.

FRM:bs
Encl.

cc: Sheaffer
Lundahl
Musick
Seeley
Schuyler
McKinney

SHEAFFER AND ROLAND, INC.
REVIEW COMMENTS

The following review comments are made on the May, 1980 draft Engineering-Science report on the proposed Northglenn system. Each of the fourteen conclusions in the Engineering-Science report are reproduced in numerical order and are immediately followed by comments prepared by the professional staff of Sheaffer and Roland, Inc.

> (1) The collection period for data describing the raw waste load to the proposed system spanned a 13-day period in February and March of 1978. The data collected were for the existing Northglenn wastewaters only and did not include analyses of the other sources, such as irrigation return flow and storm water runoff, which also will be treated. This data base does not represent a sufficient sampling and analytical effort for the proposed Northglenn wastewater treatment system. There is no assurance that the two-week period represents year round wastewater characteristics especially the very important ammonia-nitrogen:alkalinity ratio. The ammonia-nitrogen concentrations from the sampling were abnormal for municipal wastewaters and should have been investigated further, and the quality of the additional sources of wastewater and the new potable water source (Standley Lake) should have been characterized and taken into account in determining design wastewater quality.

The statement that the Sheaffer and Roland analysis "did not include analyses of other sources, such as irrigation return flow and storm water runoff" is simply false.

The City of Northglenn, in a two year cooperative program with the U.S. Geological Survey has extensively sampled stormwater runoff and irrigation return flow in five separate locations within the City. One of these locations is the actual point from which the stormwater and irrigation return flow will be intercepted for treatment. This data base represents an unusually extensive source of information far more detailed than is normally available for the design of a wastewater treatment system.

The 1978 wastewater sampling program also included tests of the Westminster sewage. Since Westminster uses

Standley Lake as its water supply, this data provided a basis for estimating the changes in sewage quality which could be expected from the new water source.

The South Platte River has been analyzed extensively over the past several years and this data is available through the EPA STORET system.(1)

All of the above data was considered in the design of the Northglenn system. This level of effort far exceeds the normal practice for the design of sewage treatment systems and represents a sound basis for proceeding with confidence on a final design.

The reference to "abnormal" ammonia level in the wastewater is unsubstantiated and incorrect. Commonly accepted ammonia levels in domestic wastewaters normally fall in the range of 12 to 50 mg/l.(2) The Northglenn wastewater falls well within this range and can not be considered abnormal for a collection system like Northglenn's with very little inflow/infiltration.

We agree with the observation made by Engineering-Science concerning the critical nature of the ammonia nitrogen/alkalinity ratio. The wastewater sampling program suggested that an ammonia nitrogen/alkalinity ratio of 0.1 should be expected for the Northglenn wastwater. Normal domestic wastewater can be expected to have a ratio of 0.2 to 0.3. The lower the ratio, the more difficult it will be to limit the growth of algae by limiting the amount of available carbon (alkalinity). As a recognition of the importance of this ratio, the Northglenn system is conservatively designed using the 0.1 ratio. If for some reason, the actual ratio is closer to the normal range, the system will operate even better than predicted.

(2) The pilot-plant studies of aerated lagoon treatment using the detention times and three-series-cell concept proposed for Northglenn were professionally performed and the results were typical of the treatment expected for long detention-time aerated lagoons. Three problems exist, however, in applying the results of these studies directly to the proposed Northglenn wastewater treatment system:

(a) Lawrence, Kansas, wastewaters, not a composite representing the actual wastewater to be treated (City of Northglenn, irrigation return flow, and storm water runoff), or City of Northglenn wastewaters, were used for the tests and differences in ammonia and alkalinity relationships between the wastewaters as well as other differences do not appear to have been adequately evaluated.

(b) There was insufficient run time under cold-weather operating conditions for the pilot facility to exhibit the response of such systems to the low temperatures which may be expected to occur in the full-scale facility.

(c) The effect of the proposed Bull Canal Reservoir on effluent quality from the proposed system was not effectively considered in the pilot studies.

The possible differences between the Lawrence, Kansas and Northglenn wastewater were carefully considered as a part of the pilot studies "professionally performed" by Dr. Ross McKinney. The pilot studies referenced on page II-14 of your report purposely selected wastewater from "Lawrence, Kansas, since it had characteristics similar to those of Northglenn, Colorado."

These pilot studies, however, did not simply stop at testing the Lawrence wastewater in its normal form. As referenced on page II-14 in report, both a low ammonia level (Pilot Study B) and a high ammonia level (Pilot Study A) wastewater were tested.

As previously mentioned, the actual design considered the differences between the quality of the wastewater used in the pilot plant and the quality of the sewage, stormwater, and irrigation return flow water expected in the Northglenn system. Engineering-Science's reference to "other differences" is not specific in terms of its effects on the proposed design. Thus, it is not clear what is meant by this comment. We are prepared to respond concerning these "differences" as soon as some specific items are identified by Engineering-Science.

In regard to cold weather effects, the pilot plant was operated during the months of October and November in the range of 5 to 17°C with 50% of the temperatures 7°C or less. These temperatures are referenced on page II-16 of your report. Since the pilot plant was more shallow and was not insulated, it tended to operate at colder temperatures than would be expected in the full scale system. This fact is also referenced on page II-15 of the Engineering-Science report. These October and November temperatures simulated the effects of a full scale operation during the critical winter months of January and February. Further comments on lagoon temperatures are provided under item 11.

Engineering-Science's opinion concerning the effect of the Bull Canal Reservoir vis-a-vis the pilot studies is vague. Perhaps Engineering Science could suggest a specific pilot plant design which would provide a more appropriate model of the reservoir's effects. We can provide further comment on this matter if Engineering-Science were to provide a specific opinion or alternative pilot plant design.

(3) The proposed Northglenn wastewater treatment system should under most conditions have no trouble meeting the proposed BOD_5 limits for the Bull Canal Reservoir effluent. Two situations could occur which could cause the permit BOD_5 levels to be exceeded:

(a) During summer or warm-weather operation, there exists a potential for high algal levels in the effluent from the reservoir. If the algae levels are high enough, the attendent BOD_5 contribution could cause permit limits to be exceeded.

(b) During winter operation, the treatment efficiency of the three-stage aerated lagoon will be significantly reduced. If the effluent BOD_5 from the aerated lagoons reaches a high enough level for a long enough period of time, the effluent from the reservoir could be affected and the effluent BOD_5 could exceed permit requirements. The possibility for high flow rates due to storm water runoff during winter operation, which would decrease average treatment time in the aerated lagoons and further decrease BOD_5 removal efficiency due to cold weather, further increases the risk of the effluent BOD_5 exceeding permit limits during winter operation.

We agree with Engineering-Science's comment that the proposed system should have "no trouble meeting the proposed BOD_5 limits for the Bull Canal Reservoir effluent." Their reference to two possible situations which might cause the permit BOD_5 levels to be exceeded are highly speculative and are without specific foundation.

The inference that algae levels could become so high as to cause a large BOD demand in excess of the permit levels ignores the proven methods of algae control commonly used in storage reservoirs.

In regard to the comment concerning a high loss of BOD_5 treatment efficiency during cold weather operations, we can only agree with the Engineering-Science comment on page II-37 that "this possibility is rather remote."

The statement concerning the major loss of treatment efficiency during high flows is difficult to believe and is directly contradictory to a statement made on page III-7 concerning a conventional treatment plant. It is extremely difficult, if not impossible, to understand how stormwater could have such an adverse effect on an aerated lagoon with a detention time of fourteen days when it will not adversely effect a conventional treatment plant with only a few hours detention time.

> (4) The probability that the proposed system will continuously meet effluent TSS requirements (30 mg/l monthly average and 45 mg/l 7-day average) is believed to be rather low. The probability of exceeding the permit requirements in the summer due to levels of algae growth in Bull Canal Reservoir is high. Another factor which could contribute to high effluent TSS during the summer is the potential for high influent flow rates carrying large sediment loads during periods of minimum reservoir volume. During winter operation, the effluent TSS should, however, pose no problem.

The statement of "belief" that the proposed system will probably not meet effluent TSS requirements due to algae is apparently based on a misunderstanding of several technical items as described above.

The statement by Engineering-Science concerning sediment loading during high flow periods is unclear. Perhaps it was thought the stormwater itself would carry a heavy sediment load to the lagoons. This is a highly unlikely event, however, due to the fact that the heavy flows will be from the South Platte River wells which will carry virtually no sediment, or from Grangehall Creek after sediment deposition in the Grangehall Creek detention pond.

Perhaps this statement was speculating on the possibilities for a carryover of sediments from the lagoons to the reservoir. This is also highly unlikely because the lagoons have detention time of 5 days even if the makeup system is operated continuously at full capacity, because the third aeration system is designed to preclude the resuspension of solids and because a dead storage area has been designed at the south end of the reservoir to capture any sediment carryover.

(5) A key operational feature of the proposed three-stage lagoon system is the achievement of essentially complete nitrification and the attendent removal of alkalinity in the second and third-stage aerated lagoons. This capability is necessary to achieve the carbon limiting system which is designed to limit algal growth in the final reservoir. Due to the very low temperatures expected in the second and third lagoon stages during cold-weather operation (below 7 and 2 degrees C for three months in cells 2 and 3, respectively) adequate nitrification to achieve this goal will not be possible. A second contributing factor to low nitrification levels in the winter will be increased BOD_5 loadings on the second and third lagoon cells due to cold weather reductions in BOD_5 removal efficiencies. This increase in carbonaceous demand will further inhibit nitrification due to the reduced capability of the nitrifying organisms to compete.

The nitrification process does not stop, but only slows down, under cold water conditions. The figure on page II-35 of the Engineering-Service report confirms this fact. This phenomenon was recognized and its effects were incorporated into the lagoon design.(3) This is actually one of the advantages of a lagoon over a conventional treatment system designed to achieve nitrification. When the process slows down in a conventional treatment system, there is inadequate detention time for nitrification. The Northglenn system, however, provides adequate detention times and 75% nitrification can be achieved in the critically cold month of January. Although this is not complete nitrification, it is adequate to achieve the desired effluent quality.

In the event additional nitrification is desired, fixed redwood media racks could be installed easily and inexpensively at a later date.

Comments regarding the temperature effects on the lagoons during cold weather periods are included under item 11. The comment regarding the possible carryover of carbonaceous BOD to the third cell may occur in a system with a low level of mixing in the first cell but it will not occur with a high level of mixing as included in the Northglenn design.

(6) The capability of the proposed Northglenn system to maintain carbon limiting conditions to inhibit algal growth in the Bull Canal Reservoir and thus attain effluent TSS requirements is dependent on a complex series of reactions and interactions. No controls of phosphorus or nitrogen are proposed, and it is recognized that sufficient amounts of these nutrients will be available to support large algal growths. The ability of the proposed system to achieve the desired carbon limiting conditions is dependent upon many factors. The following are believed to be the most important of these factors:

(a) essentially complete nitrification in the aerated lagoons with attendent alkalinity removal;

(b) 30 to 35 mg/l of ammonia-nitrogen in the raw waste on a continuous basis;

(c) essentially complete removal of carbonaceous BOD_5 in the aerated lagoons; and

(d) exceptionally low, for aerated lagoons, effluent TSS from the lagoons to the reservoir.

The high potential for BOD_5 losses in the 30 to 50 mg/l concentrations, the high potential for low or no nitrification rates and thus high alkalinity during winter operation, the carryover of organics-containing TSS from the lagoons to the reservoir, and the direct transfer of carbon dioxide from the atmosphere to the reservoir combined to make it unlikely that a carbon limiting system can be maintained in the reservoir.

Responses to items a, b and c are included in other sections of this report. Item d is vague in its definition of "exceptionally low." The effluent TSS from the lagoons to the reservoir in the final design are within the limits typically found for a lagoon with low levels of mixing smilar to the cell 3 design. Perhaps the concern expressed by Engineering Science is predicated on the full continuous usage of the entire blower capacity available for cell 3. This capacity will not be used continuously, but will be available on a stand-by basis to accomodate any unusual short-term loadings. If any unusual unforseen problems develop, the aerators nearest to the outlet could be turned off to encourage further settling and the blower capacity could be reallocated to other portions of the system.

In its statements concerning the possible carbon dioxide transfer from the atmosphere, Engineering-Science did not even attempt to quantify the potential for algae growth. The maximum contribution of carbon dioxide from the atmosphere would result in a potential maximum algae growth of 4-5 mg/l.(30) This potential was considered in the design of the systems and will not cause effluent limitations to be violated.(31)

(7) The proposed Northglenn system should exhibit excellent removals of fecal coliforms due to both the long detenton times through the aerated lagoons and Bull Canal Reservoir and the capability of chlorinating the reservoir's effluent. The State of Colorado has proposed effluent fecal coliform requirements of 1,000/2,000 colonies per 100 ml for the 30-day and 7-day averages for the reservoir effluent. Only extreme circumstances such as severe short-circuiting in the reservoir or complete loss of biomass in the aerated lagoons could produce excessive effluent levels under these requirements. For the 1,000/2,000 limits, the necessity for chlorination, proposed for as-required operation, should be minimal. EPA will require stricter limits of 200/400 colonies per 100 ml. These limits could very well require chlorination of the reservoir effluent for considerable periods of time and possible at all times.

(8) The design of the proposed Northglenn system, which utilizes three aerated lagoons in series with a long detention time in the final reservoir should result in a very low potential for problems concerning the transmission of waterborne diseases due to the influent wastewaters. Add to this the capability of chlorinating the effluent from the reservoir if the fecal coliform level increases and the system appears to be adequately safeguarded in terms of waterborne disease transmission potential.

We agree with the conclusions in statements 7 and 8.

(9) The design of the aeration system for the first aerated lagoon cells will not be capable of maintaining complete suspension of suspended solids. This is due primarily to the geometry of the cells and the effective zone of complete mixing for static aerators. Thus, some settling of suspended solids on the sidewalls of the first-stage lagoons can be expected. This is not expected to seriously impair system efficiencies. It does, however, represent a departure from the system specifications as set forth by Sheaffer and Roland, Inc. and Dr. McKinney.

We agree there may be some minor deposition of solids along the outer slopes of Cell I. This deposition, however, will not be a significant source of odors and we agree with your statement that it will not seriously impair system efficiencies. We are in the process of clarifying our specifications on this matter to avoid any confusion during the award of the construction contracts for the lagoons.

(10) The location of static aerator tubes near the effluent structures in the third-stage lagoons may cause problems in terms of effluent TSS concentration from the third lagoons. These aerators, when in use, may keep suspended solids which might otherwise have settled out from settling. The intermittent use of these aerators could lead to short-term high TSS concentrations in the lagoon effluent due to resuspension of previously settled solids in the areas around these aerators.

Our response to this statement is included under item 6.

(11) The temperature calculations for cold-weather operation made by Sheaffer and Roland, Inc. utilize an equation designed for quiescent lagoons. The temperatures thus calculated for winter conditions are too high for the statically aerated and mixed lagoon system proposed for Northglenn. The negative effects of cold weather on BOD_5 removal and nitrification during winter operation cited previously may thus be further magnified.

This conclusion is both unsubstantiated and inaccurate, and appears to be based only upon the personal opinion of Engineering-Science reviewers. The temperature calculations used by Sheaffer and Roland, Inc. are specifically applicable to aerated lagoons and have been verified by extensive comparisons to existing aerated lagoon systems.

Engineering-Science maintains on page III-5 that the temperature calculation underestimates the heat losses from mixed lagoons and as a result, the design treatment efficiencies will not be achieved:

> The temperature loss calculations prepared for the aerated lagoon system by Sheaffer and Roland, Inc. are shown in Table III-1. These calculations underestimate the heat loss from mixed aerated lagoons. The calculation procedure shown on the table is for quiescent lagoon systems. This causes major errors in estimating heat loss for aerated-mixed lagoons for two reasons: (1) the mixing action continuously brings warmer subsurface waters to the surface thus allowing additional heat transfer to the atmosphere, and (2) the mixing action prevents the formation of a relatively stable thermal zone at the surface which normally inhibits heat transfer, in quiescent lagoons, to the lower levels by maintaining a low differential temperature at the air/water interface to impede convective heat transfer (i.e., the upper water layer acts as an insulator for the lower layers).
>
> Thus, the estimates of BOD_5 removals and nitrification which have already been questioned may be even more seriously impacted due to lower than anticipated water temperatures in the aerated lagoons and reservoir. As an example, by assuming that the surface heat exchange coefficient (k) is double that used by Sheaffer & Roland, Inc. in their calculations (this assumption is believed to be a conservative assumption in terms of comparison to what the actual k values are for statically aerated lagoons), the January lagoon temperatures calculated would be 8.5 degrees C in cell number 1 (compared to 10.5 degrees C), 1.9 degrees C in cell number 2 (compared to 5.4 degrees C), and -2.2 degrees C in cell number 3 (compared to 0.3 degrees C). At these low temperatures, nitrification and BOD_5 removal would be almost nonexistent in the second and third cells.

Theabove statements by Engineering-Science are based on their belief that the calculation procedures used in the design are not applicable to aerated lagoons. Engineering-Science's beliefs, however, are not supported by any published reference or empirical data. The simple fact is the equation is intended to be used for aerated lagoons:

> Aerated lagoon temperatures can be estimated with a relationship derived from a thermal energy balance across a complete mix system...to determine the lagoon water temperature during the coldest week of the year, the value of the surface heat exchange coefficient k can be assumed to be equal to 0.7×10^6.(4)

The accuracy of this calculation was confirmed by the author using actual operating data collected form numerous full scale systems in Oregon, Ohio, Indiana and Texas. Additional research by others has confirmed that mixing is not a major factor in determining an appropriate k value even for lagoons with a much higher level of mixing.(29)

The use of the equation is further substantiated by the Niwot, Colorado and Windber, Pennsylvania aerated lagoons.(5,6) Although these systems are subject to higher thermal losses than the Northglenn design, their water temperatures have not equalled the extreme cold postulated by Engineering-Science.

The Niwot system contains a 15-day detention time surface aerated lagoon which receives raw influent wastewater and discharges to a quiescent second cell. The water temperature of the first cell was monitored over the winter of 1973-1974. The lowest temperature reported was 2°C. This is significantly higher than the water temperatures predicted by Engineering-Science for the third cells of the Northglenn system in spite of the fact that the Niwot first cell has more detention time, a higher surface to volume ratio and a more turbulent form of aeration than the Northglenn lagoons. In the case of the Windber, Pennsylvania, aerated lagoon system, the influent and effluent wastewater temperatures from the 47-day three-cell aerated system were monitored over a three-year period. At no time did the effluent wastewater temperature drop below 2°C in spite of longer detention times, higher surface to volume ratios an a climate more severe than that of Northglenn. It can therefore be concluded that the temperature calculations used by Sheaffer & Roland are adequately documented, appropriately conservative, and applicable to the Northglenn design.

The arbitrary doubling of the surface heat exchange coefficient k is arbitrary and without substantiation. Exactly who believes that doubling k is an appropriate assumption is not discussed. One must, therefore, assume that this is only the personal opinion of the Engineering-

Service staff. It is difficult to accept this opinion in light of the actual operating data which does not support such an opinion. The weakness of their opinion is also betrayed by the results which would follow if it were true (i.e. a water temperature of -2.2°C in cell 3 is an impossibility for liquid water). This statement, therefore, incredibly seems to imply that the water in cell 3 will be a solid block of ice. This type of an unsupported analysis does not do justice to the EIS process.

(12) The aeration energy requirements for the proposed Northglenn wastewater treatment system were compared to the estimated total energy requirements for treatment using extended aeration, activated sludge, and rotary biological contactors. The Northglenn aeration energy requirements are from 20 to 800 percent greater than the estimated energy requirements for these other systems.

(13) The total estimated energy requirements for the proposed Northglenn wastewater treatment system, including aeration and conveyance energy and other miscellaneous requirements, were compared to the estimated energy for conveyance to and treatment by Denver Metro. The results of this comparison indicate that the proposed Northglenn wastewater treatment system will require approximately 60 percent more energy than treatment by Denver Metro.

These conclusions are based on a comparison of extremely unrealistic conditions and are inconsistent with the EPA regulations on energy impact analyses. As a result, they are misleading to the public and are not worthy of inclusion in the final EIS. The conclusion of a proper analysis is that treatment at Metro Denver will require the consumption of 280% to 450% of the energy required for the Northglenn proposal.

EPA guidelines for energy impact analyses are found in the regulations.(7) The intent of these regulations are further explained in an EPA handbook for the Preparation of Environmental Assessment of Construction Grant Projects:

> Because of the recently increased concern about the limited resources available to meet our energy needs, the environmental assessment should include an analysis of energy impacts. Impacts include the energy required to operate the treatment plant, to manufacture chemicals used in wastewater treatment and to meet the demand of future population and industrial complexes.(8)

The regulations also require that the use and recovery of energy and scarce resources such as nutrients be included in the analysis.(9) Nitrogen fertilizers are an energy intensive product which will be conserved under the Northglenn plan through the Agricultural Reuse Manual. The appropriate credits for the recovery of these energy-intensive nutrients should therefore also be included in the analysis.

The proper type of an analysis was submitted to EPA in the Fall of 1978 and was included in the Negative Declaration.(10,11) That analysis concluded that the Northglenn plan will consume 6 to 23% less energy than treatment at Metro Denver to meet current discharge permit requirements. Although that analysis was based on a system intended to treat a larger portion of Thornton sewage than the current plan, it is unclear why Engineering Science chose to abandon that type of analysis and substituted an analysis which ignores several energy consuming items at Metro Denver, used several treatment alternatives which are either incompatible with the Metro Denver system or are incapable of meeting the discharge permite requirements, overestimated the energy requirements of the Northglenn plan, and ignored the energy recovery aspects of the Northglenn plan.

An updated energy budget for the Northglenn plan is included in Table 1. It includes the energy requirements at the full design flow rate of 4.64 MGD and includes sufficient energy to meet the design effluent requirements with the expected flow variations due to the various makeup water sources.

The collection and interceptor system energy requirements are based on the already completed final system design. They are 36% less than the estimates prepared by Engineering-Science. The largest part of the discrepancy is believed to be the result of the fact that Engineering-Science improperly included the energy requirements of the makeup water system in its calculations. It is not consistent to include the makeup water for the Northglenn alternative since it is not included for the Metro Denver alternative.

The aerated lagoon energy consumption is also based on the final design and the expected level of performance of the system. The energy requirements of Cells IA and IB are governed by mixing which in turn is governed by the volume of water in these cells. The mixing requirements, therefore, do not vary with flow rate and the actual requirements will average 134 horsepower. The achievement of less than a complete mix along the outer edges of cells IA and IB is not expected to hinder system performance.(12) The installed horsepower of 200 is included for safety purposes only for those short periods of time when oxygen transfer requirements might exceed mixing requirements. It is not appropriate to include this redundancy in estimates of energy requirements any more than it is appropriate to include the total installed horsepower capacity at a conventional treatment plant.

The energy requirements for Cells IIA and IIB are governed by oxygen transfer requirements. Based on an oxygen transfer efficiency of 1.0 lb. of oxygen transfer per horsepower hours, 266 year around average horsepower is adequate to provide the desired level of treatment. The aeration system as it is designed has been shown to transfer 3.0 lbs. of oxygen per horsepower hour and it is possible to justify the use of only 90 horsepower in cells IIA and IIB based on aeration requirements alone.(13) Such a low level of horsepower, however, may not achieve the desired level of mixing in Cells IIA and IIB. Thus, the estimates of energy requirements are based on a mid range horsepower requirement of 178. Additional redundancy is also available since 400 horsepower will be installed and reserved for Cells IIA and IIB. This additional horsepower, plus the conservatively low assumptions concerning oxygen transfer efficiencies will more than adequately accomodate variations in rate and quality of wastewater flow. It is intended, however, only for occasional use and most certainly will not be used on a continuous basis. This design approach provides a high degree of safety in the expected performance of the system. Engineering Science's presumption that 280 horsepower will be used continuously is simply not supported by the facts.

The energy requirement for Cells IIIA and IIIB are controlled by the oxygen requirements to achieve nitrification. The rate of nitrification will vary from month to month with the peak rate (and therefore peak oxygen requirements) during the summer months. Based on a conservatively low oxygen transfer rate of 2.1 lbs. oxygen per horsepower hour and an average nitrification biological efficiency

TABLE 1

Northglenn System Energy Requirements

ITEM	ANNUAL REQUIREMENT (000's KWH/YR)
Collection System Pump Stations	
B (65' TDH, 0.90 MGD)	95.9
D (132' TDH, 0.03 MGD)	6.5
E (120' TDH, 0.02 MGD)	3.9
F (55' TDH, 0.05 MGD)	4.5
G (25' TDH, 0.02 MGD)	0.8
Subtotal Collection System	111.6
Interceptor System Pump Stations	
A (77' TDH, 4.64 MGD)	604.0
Subtotal Interceptor System	604.0
Aerated Lagoons	
Cells IA & IB (134 HP)	972.6
Cells IIA & IIB (178 HP)	1292.0
Cells IIIA & IIIB (58 HP)	421.0
Cells IIIA & IIIB Safety Factor (30 HP)	217.7
Subtotal Aerated Lagoons	2903.3
Storage and Discharge	
Reservoir Mixing (8 HP)	52.2
Discharge Pumping (19' TDH, 4.64 MGD)	144.5
Chlorination	
Operation (70.6 tons/yr.)	38.0
Manufacture (70.6 tons/yr.)	282.5
Transportation (Gulf Coast by Rail)	13.9
N Fertilizer Value	
Manufacture (154-218 tons/yr.)	(2,035.5 - 2,874.3)
Delivery (truck, 30 miles round trip)	(2.3 - 3.3)
Subtotal Storage & Discharge	(2,346.5 - 1,506.7)
Sludge Management	
Land Application (247,000 ft^3/yr.)	88.0
N Fertilizer Value (7 tons/yr.)	(94.9)
Subtotal Sludge Management	(6.9)

TABLE 1

(Continued)

ITEM	ANNUAL REQUIREMENT (000's KWH/YR)
Miscellaneous	
Dacono Disinfection	
Operation (1 ton/yr.)	0.1
Chlorine Manufacture (1 ton/yr.)	4.0
Chlorine Transportation (Gulf Coast by Rail)	0.2
Tailwater Control	14.0
Field Monitoring (600 miles/yr.)	40.9
Metering and Miscellaneous Power (10 HP)	65.3
Subtotal Miscellaneous	124.5
TOTAL System Requirement	1,390.0 - 2,229.8

coeffient of 0.48, an average total horsepower of 58 for Cells IIIA and IIIB will be adequate to provide the design levels of nitrification.

Sheaffer and Roland agrees with Engineering Science's comment that if the third cells are left unaerated, some odor problems may develop.(14) But we do not agree that the entire 280 horsepower installed for Cells IIIA and IIIB will be used on a continuous basis. If it were to be used in this manner, some of the problems mentioned by Engineering Science such as solids carryover into the reservoir might occur. Such a continuous operation would not be prudent and it is misleading to base energy requirements on such an operation.

For the purposes of this estimate, we have used an additional continuous 30 horsepower beyond the computed value of 58 horsepower as a 50% safety factor. This safety factor will provide additional nitrification and BOD reduction during extended periods of high flow or high strength wastewater. The 280 installed horsepower provides additional system redundancy (250%) for short-term variations in flow. As is the case with Cells I and II, it is unreasonable to presume that this entire capacity will be used on a continuous basis in estimated energy requirements.

The storage reservoir mixing requirements are based on a demand of 0.004 horsepower per acre foot with an average storage of 2000 acre feet(15)

The discharge pumping is for the sewage portion of the total return flow at an average pumping head of nineteen feet. Only the sewage portion was included since the delivery of return flows are not included in the Metro Denver alternatives.

The electrical energy requirements for chlorination are based on an average chlorine dosage of 10 parts per million to the treated sewage portion of the flow. This is a reasonable estimate for a chlorine dosage and is significantly higher than the 1.5-2.0 parts per million dosage applied at Metro Denver. The energy requirements for the manufacturing and delivery of chlorine to the site are based upon an EPA publication with transportation by rail from the Gulf Coast.(16)

The energy value of the nitrogen contained in the wastewater is based on a manufacturing of anhydrous ammonia from natural gas and delivery by truck to the farm from a local plant. A range of 154 to 218 tons per year of elemental N will be delivered to the Bull Canal farms depending upon the amount of nitrogen lost during storage.(17) This is the equivalent of 187 to 265 tons per year of anhydrous ammonia which requires 35,000-38,000 ft^3 of natural gas per ton to manufacture which has an annual equivalent energy value of 13,200 KWH per ton.(18) These savings are expected as a result of Northglenn's program to inform the farmers of the available nitrogen in the wastewater through the Agricultural Reuse Manual. The storage reservoir will allow sufficient flexibility in operation to assure that the nitrogen application will provide the maximum benefits to the farmers.

The energy requirements for sludge management are for the dredging and land application of 247,000 ft^3/yr. of sludge(19,20) containing 7 tons/yr. of useful elemental nitrogen

The miscellaneous energy requirements include disinfection of the Bull Canal water for Dacono, the tailwater control program near Frederick and the field monitoring program.(21,22,23) A miscellaneous power requirement of 10 horsepower is also included for items such as metering, yard lighting, heating, etc.

A corrected energy requirement for the Metro Denver alternative is included in Table 2. This requirement includes the necessary energy to meet the discharge permit requirements at Metro Denver using a system compatible with the present facility as defined in Metro Denver's Facility Plan.(24) In contrast to the estimate prepared by Engineering Science, this analysis does not include any systems incompatible with the Metro facility and it does not make comparisons with systems that are incapable of meeting the discharge permit requirements.

The energy requirements for the collection and interceptor system include all the pump stations necessary to deliver the full 4.64 MGD to the Metro Denver Central Plant. These estimates are approximately 15% higher than estimated by Engineering Science. The discrepancy appears to be primarily due to the fact that Engineering Science did not include the collection system energy in the Metro Denver alternative even though the collection system energy was included in the analysis of the Northglenn alternative.

The energy requirements for primary treatment, secondary treatment and sludge handling are based upon a unit

TABLE 2

Metro Denver System Energy Requirements

ITEM	ANNUAL REQUIREMENT (000's KWH/YR)
Collection System Pump Stations	
D (132' TDH, 0.03 MGD)	6.5
E (120' TDH, 0.02 MGD)	3.9
F (55' TDH, 0.05 MGD)	4.5
G (25' TDH, 0.02 MGD)	0.8
Subtotal Collection System	15.7
Interceptor System Pump Stations	
Henderson (173' TDH, 3.74 MGD)	1,060.7
North Washington (60' TDH, 0.90 MGD)	88.5
Subtotal Interceptor System	1,149.2
Metro Denver Secondary Treatment	
South Primary Electrical (4.64 MGD)	92.1
South Secondary Electrical (4.64 MGD)	1,526.7
Subtotal Secondary Treatment	1,618.8
Sludge Management	
WAS Concentration	
Electricity (654 dry tons/yr.)	45.5
Polymer Manufacturing (37,300 lbs/yr.)	3.7
Polymer Transportation (37,300 lbs/yr.)	~0
Anaerobic Digestion Electricity (1191 tons/yr.)	131.8
Solids Dewatering	
Electricity (1351 dry tons/yr.)	55.4
Ferric Chloride Manufacturing (101 tons/yr.)	101.2
Ferric Chloride Transportation (Pueblo, CO. by rail)	1.6
Holding Tanks	
Electricity (3690 dry tons/yr.)	32.4
Lime Manufacturing (247 tons/yr.)	148.1
Lime Transportation (Lyons, CO. by rail)	1.9
Digested Solids Dewatering	
Polymer Manufacturing (2 tons/yr.)	0.4
Polymer Transportation (2 tons/yr.)	~ 0
Solids Disposal	
Liquid (8050 wet tons/yr.)	67.2
Cake (9007 wet tons/yr.)	188.0
Subtotal Sludge Management	777.2

TABLE 2

(Continued)

ITEM	ANNUAL REQUIREMENT (000's KWH/YR)
Biological Nitrification	
Electricity (1117 MG/yr.)	730.0
Subtotal Biological Nitrification	730.0
Breakpoint Chlorination Nitrification	
Electricity (372 MG/yr.)	85.0
Chlorine Manufacturing (416 tons/yr.)	1,664.4
Chlorine Transportation (Gulf Coast by rail)	81.7
Sulfur Dioxide Manufacturing	20.0
Sulfur Dioxide Transportation	~ 0
Subtotal Breakpoint Chlorination	1,851.1
Disinfection	
Biological Nitrification Effluent (1117 MG/yr.)	40.3
Breakpoint Chlorination Effluent (372 MG/yr.)	0
Chlorine Manufacturing (10.2 tons/yr.)	40.7
Chlorine Transportation (Gulf Coast by rail)	2.0
Subtotal Disinfection	83.0
Miscellaneous	
Supporting Maintenance	113.2
Subtotal Miscellaneous	113.2
TOTAL System Requirement	6,338.2

process by unit process analysis of the 1980 Metro Denver Budget.(25) This is necessary since Metro Denver does not provide primary treatment and all of the sludge handling for its entire 1980 flow of 123 MGD. Thus a simple pro rata share of these energy costs based on 4.64/123 would result in a misleading low estimate. The energy requirements include the manufacturing and transportation of those chemicals in a manner consistent with the EPA guidelines. These guidelines require a full accounting of the primary and secondary impacts of a proposed plan and its alternatives.

The energy requirements for the South Primary Complex and the South Secondary Complex are mainly electrical energy. The sludge handling processes include electrical energy as well as the manufacturing and transportation of various chemicals used for sludge conditioning. The energy costs associated with hauling liquid sludge and sludge cake to the Lowry Bombinhg range and its vicinity are also included. The chemical requirements are based upon the 1980 Metro Denver budget. The basis for the various other estimates are summarized as follows using EPA publications and known sources for the chemicals:

a) Polymer production requirement of 0.1 KWH/lb. with polymer transportation energy negligibly small;

b) Ferric chloride production of 0.5 KWH/lb. with transportation by rail from Pueblo, Colorado at a rate of 670 BTU/ton-mile;

c) Lime production of 0.3 KWH/lb. with transportation by rail from Lyons, Colorado;

d) Disposal of 6% solids liquid sludge by truck 10 miles from the plant at a rate of 1425 BTU/ton-mile;

e) Disposal of 15% solids cake sludge 25 miles from the plant at a rate of 1425 BTU/ton-mile

The energy requirements for nitrification are based on a suspended growth biological nitrification system with breakpoint chlorination as a backup system to assure permit compliance during cold weather and peak flow periods. This type of system has been favored by Metro Denver in its Facility Plan since it is compatible with the existing facilities, will provide reasonable assurances that discharge permit requirements can be met consistently and it is compatible with possible future plant expansion.

For the purpose of this analysis, we have also assumed that it will not be necessary to nitrify the portion of the effluent (12%) which is discharged to the Burlington Canal. It is also assumed that the breakpoint chlorination system will be used to treat 25% of the effluent requiring nitrification. The EPA design manual on nitrification control recommends that a backup system should be sized to provide a minimum safety factor of 50%.(26) It is further assumed that this backup system will be used only 50% of the time. Thus, approximately 25% of the nitrification flow will use breakpoint chlorination. This represents a reasonable estimate of the energy requirements for the backup system even though it does not provide the same high level of redundancy as proposed in the Northglenn system.

The energy requirements for the suspended growth biological nitrification and breakpoint chlorination are based on Figures III-33 and III-73 of the EPA publication on Energy Conservation in Municipal Wastewater Treatment using a permit effluent requirement of 1.5 parts per million with an influent concentration fo 35 parts per million. The influent concentration is the same one used in analyzing the Northglenn alternative and provides a consistent basis comparing the two systems. The sulfur dioxide is required to dechlorinate the flows passing through the breakpoint chlorination system to meet the 0.05 parts per million residual chlorine requirement in Metro Denver's discharge permit.

The energy requirements for disinfection include only those flows which do not require breakpoint chlorination. It is assumed that additional disinfection will not be required after breakpoint chlorination and sulfur dioxide dechlorination.

The miscellaneous energy requirements are calculated based on a pro rate share of the 1980 Metro Denver budget for support maintenance. This item inlcudes energy for yard lighting, repair garages and other miscellaneous items.

There is no credit for nitrogen fertilizer values in the Metro Denver alternative since it does not include a storage reservoir to manage the nutrients to make them available to the downstream crops when they are needed and Metro Denver does not have any mechanism for identifying the amount of nitrogen available from the effluent to the various canals diverting water from the South Platte.

(14) Several measures for algae control within the Bull Canal Reservoir, should this become necessary, have been analyzed. These measures included: (a) use of algicides, (b) use of flocculants, (c) use of biological controls (algae-consuming fish, primarily tilapia), (d) selective discharge, and (e) filtration. Biological controls and selective discharge are potential measures for the reduction in algal and suspended solids in the reservoir effluent. Selective discharge is a design feature of the proposed effluent facilities and provides operational flexibility for suspended solids control. If it is necessary to implement additional suspended solids controls, and if Northglenn selects biological organisms as the control strategy (non-native species such as tilapia), it will be necessary to ensure total containment of the species. This containment is desirable to prevent introduction into State waters and prevent competition with native, game species. Containment will require proper-sized screening of outlet structures and/or continuous chlorination.

These conclusions seem to imply that biological controls and selective discharge are the only viable algae control measures available to Northglenn. The use of algicides for algae control is not discussed in the conclusions, but the following statements appear on page III-10 of the Engineering-Science report.

> The use of algicide or flocculants to control algae growth in the reservoir is a stop gap method and does not eliminate the root cause of such growth, that is excessive supplies of nutrients and carbon for algal growth. Thus, it may be effective on a spot basis or for a period of time, but it does not represent a long-term solution to algae growth except through repeated applications.
>
> The use of repeated applications of algicides such as the $CuSO_4$ proposed at Northglenn could lead to unacceptable buildup of copper concentrations in the reservoir sediments and impact crops irrigated with the water.

This discussion dismisses the use of algicides as a "stop gap" measure and a hazard to irrigated crops in spite of the fact that this measure has been widely used with consistent success in drinking water supply reservoirs across the country for years. This was previously discussed in the Sheaffer & Roland, Inc. memorandum on algae control measures dated February 25, 1980. The low alkalinity waters of the Northglenn Reservoir will require low dosages (less than 0.1 mg/l) of copper sulfate algicide to effectively control algae in a given year.

It is anticipated that the use of copper sulfate as a measure will be able to be used on a repeated application basis if needed without any adverse economic or environmental impacts. Assuming a worst case economic condition (that each year's application of algicide would completely wash out of the reservoir) the annual cost would be less than $1,000 at current prices. With respect to potential environmental impacts, the amounts of copper sulfite needed would pose no difficulties. Assuming that all of the copper sulfate applied to control algae would leave the reservoir and be applied to crops, the concentration in the irrigation water would be less than 0.02 mg/l which is well within the acceptable limits for sugar beets, which are sensitive to copper.(27) At this level, and assuming an annual application rate of 18" per year of irrigation water, cooper would accumulate in the soil at an annual rate of 0.01 kg/ha. It would take over 400 years of such accumulation before cumulative levels would reach current EPA limits for cadmium which is a much more worrisome metal than copper.(28)

With respect to copper build-up in reservoir sediments, if all the copper applied annually were to settle out in the reservoir this would contribute only 60-65 kg of copper to the 130 acre reservoir bottom each year.

This rate of accumulation of a copper residual is slow and could be routinely monitored as a part of the system's operation. Contrary to the opinion expressed by Engineering-Science, a build-up of copper in the sediments would be the ideal situation. The copper would then be slowly released into water solution and the algae would be prevented from growing without additional applications of copper sulfate. Since the accumulation in the sediments is slow, any build-up in the amount of copper in solution is also slow. This provides a natural protective device since the concentration of copper needed to control algae is one-half the amount which is harmful to any crops. Thus, algae control on a continuous basis would be achieved without harming the crops and might reduce the need for future copper sulfate additions to the reservoir.

FOOTNOTES

[1] U.S. Environmental Protection Agency, STORET, South Platte at 88th Avenue, STORET DATE 79/05/30.

[2] Metcalf and Eddy, Wastewater Engineering: Collection, Treatment, Disposal, McGraw-Hill, 1972, p. 231.

[3] Sheaffer and Roland, Memorandum to Bob McGregor from Lee Rozaklis, RE: NPDES Permit for the Bull Canal Reservoir, November 16, 1979, p.7.

[4] White, Stan C. and Linvil G. Rich, How to Design Aerated Lagoon Systems to Meet 1977 Effluent Standards, Water and Sewage Works, March-June, 1976, (Four Parts), p. 82, April Issue.

[5] Balkum, Earl T., Aerated Wastewater Pond Process and the Mass Transfer of Oxygen from Air Bubbles, Doctoral Dissertation, University of Denver, May, 1975.

[6] Personal Communication, Windber Area Sewage Authority, Windber, Pennsylvania, March, 1979.

[7] Federal Register, Vol. 43, No. 188, Wednesday, September 27, 1978, p. 44060.

[8] EPA, Environmental Assessment of Construction Grants Projects, EPA-430/9-79-007, FRD-5, January, 1979, p. 52.

[9] Federal Register, Volume 43, No. 188, Wednesday, September 27 1978, Appendix A, 6.a., p. 44087.

[10] U.S. Environmental Protection Agency, Region 8, Negative Declaration, Project Number C 080416-01 (Step 2), Northglenn Wastewater Treatment Facility, September 29, 1978, p. 47-48.

[11] Sheaffer & Roland, Letter report RE: Metro Denver Alternatives July 31, 1978.

[12] Engineering Science, A Review of Proposed Northglenn Wastewater Treatment System, May 1980, p. III-3.

FOOTNOTES
(Continued)

[13] Gilbert R. Gary and S. J. Chen, Testing for Oxygen Transfer Efficiency in a Full Scale Deep Tank, 31st Purdue Industrial Waste Conference, May 4, 1976, Figure 14.

[14] Engineering Science, A review of Proposed Northglenn Wastewater Treatment System, May, 1980, P. III-3.

[15] Artificial Destratification in Reservoirs - A Committee Report, Journal AWWA 63:9:597, September, 1971.

[16] U.S. Environmental Protection Agency, Energy Conservation in Municipal Wastewater Treatment, EPA 430/9-77-011, MCD-32, March, 1978, pp. 4-3 and 4-4.

[17] Memorandum from McGregor to Lundahl, Musick, Wilson, Udin, and Sheaffer, RE: Nitrogen Applications in Northglenn/FRICO Reuse Area, Sheaffer and Roland, August 29, 1979.

[18] Personal Communication, Dick Rortvordt, U.S. Department of Agriculture, Washington, D.C. (202) 447-7340, May 16, 1980.

[19] Sheaffer and Roland, Letter Report, RE: Impacts of Northglenn's Proposed Sludge Management Plan and Compliance with EPA, State and Local Requirements, February 25, 1980.

[20] U.S. Environmental Protection Agency, MCD-32, Figure 3-103.

[21] Memorandum from McGregor to Lundahl, Musick, Sheaffer, Wilson and Udin, Sheaffer and Roland, September 13, 1979.

[22] Sheaffer and Roland, Letter Report, RE: Preliminary Field Monitoring Program, February 25, 1980.

[23] Sheaffer and Roland, Letter Report, RE: Preliminary Design of Tailwater Control Plan, February 25, 1980.

[24] Black and Veatch, Central Plant Facility Plan, Phase I Report, Metropolitan Denver Sewage Disposal District No. 1, June, 1979.

[25] Metropolitan Denver Sewage Disposal District No. 1, 1980 Budget, June 30, 1979.

FOOTNOTES
(Continued)

[26] U.S. Environmental Protection Agency, Technology Transfer, Process Design Manual for Nitrogen Control, October, 1975, p. 4-15 to 4-20.

[27] Personal Communication, Ron Brenton, Director of Environmental Programs, Great Western Sugar Company, February, 1980.

[28] Federal Register, Volume 44, No. 179, Part 257, Criteria for Classification of Solid Waste Disposal Facilities and Practices, September 13, 1979, p. 54362.

[29] Bishop, N.E., Studies on Mixing and Heat Exchange in Aerated Lagoons, Technical Report CRWR 78, Center for Research in Water Resources, University of Texas at Austin, January, 1975.

[30] Stumm, W. and J. J. Morgan, Aquatic Chemistry, Wiley Interscience, 1970, p. 154-55.

[31] Sheaffer and Roland, Memorandum from Lee Rozaklis to Bob McGregor, Re: NPDES Permit for the Bull Canal Reservoir, November 16, 1979, p. 11.